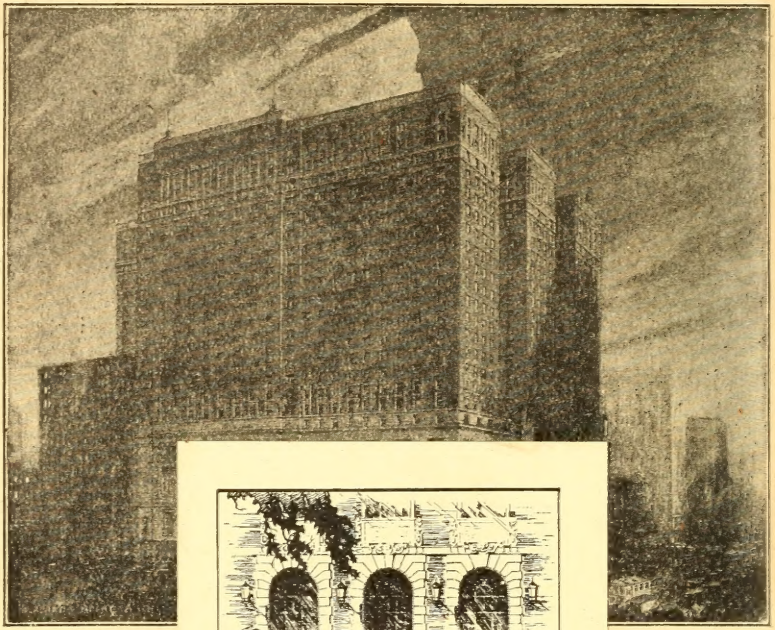
HANDBOOK FOR

ARCHITECTS AND BUILDERS

PUBLISHED
UNDER THE AUSPICES
OF THE

Illinois Society of Architects

VOL. XXVIII. 1925



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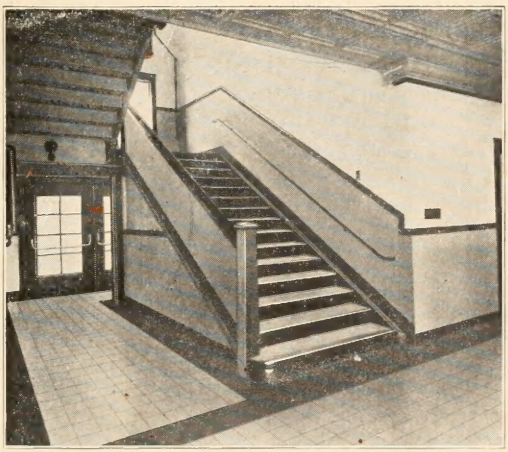

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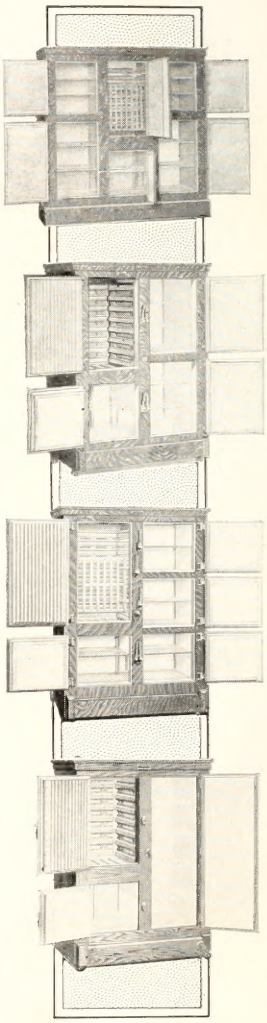

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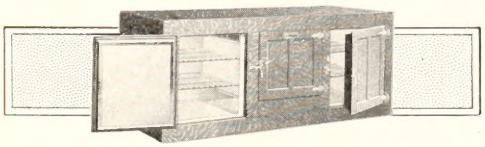

HANDBOOK

FOR

ARCHITECTS AND BUILDERS

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1925

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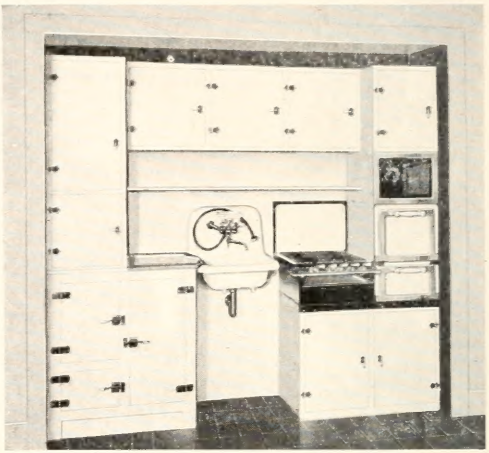

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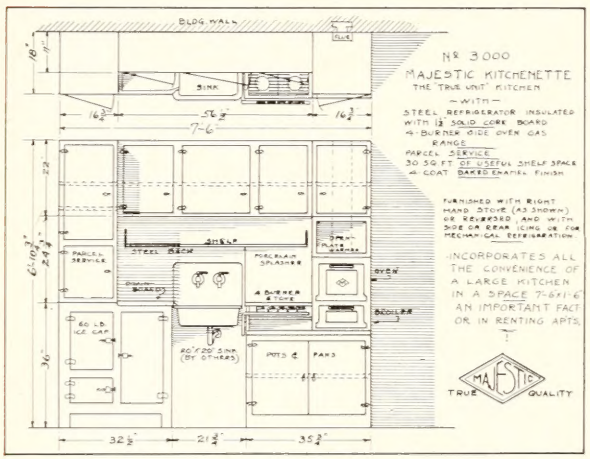

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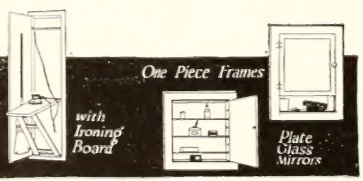

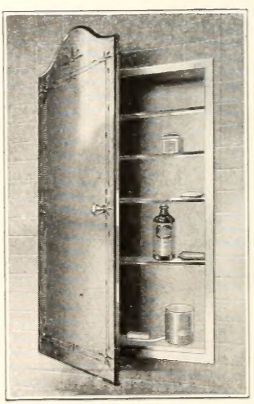

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PREFACE

The Twenty-eighth Edition of the Handbook for Architects and Builders is before you.

Changes have been made in the various ordinances and new amendments passed by the City Council have been added.

New articles have been added and the subject matter republished has been carefully revised, corrected and extended.

The Staff of our Contributors remains the same with the exception of Mr. F. E. Brown, Structural Engineer, who contributes an article on Foundations in Chicago.

We ask the indulgence of our readers with regard to the judgment used in the selection of matter as we realize that notwithstanding the care and caution which has been exercised in editing and preparing this volume that inaccuracies may have crept into this work and for such faults we ask our readers to forward to us their friendly criticism and suggestions in order to improve succeeding editions.

The Handbook for Architects and Builders covers a peculiarly exclusive field and is a recognized reference work for everyone interested in Architecture and Building.

The demand for this publication is constantly increasing and it has become almost indispensable to Architects, Engineers, Contractors and Builders and those connected with the building trades.

Our Classified Index furnishes the Architect with a list of those engaged in the manufacture and sale of material and the contracting business. We have exercised our best judgment in the selection of those represented in our book and we urge Architects, Engineers and Builders to use this list.

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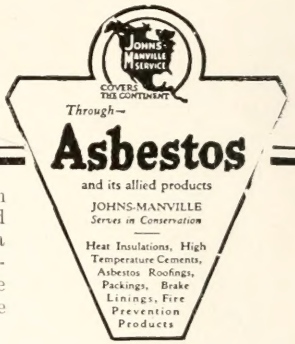

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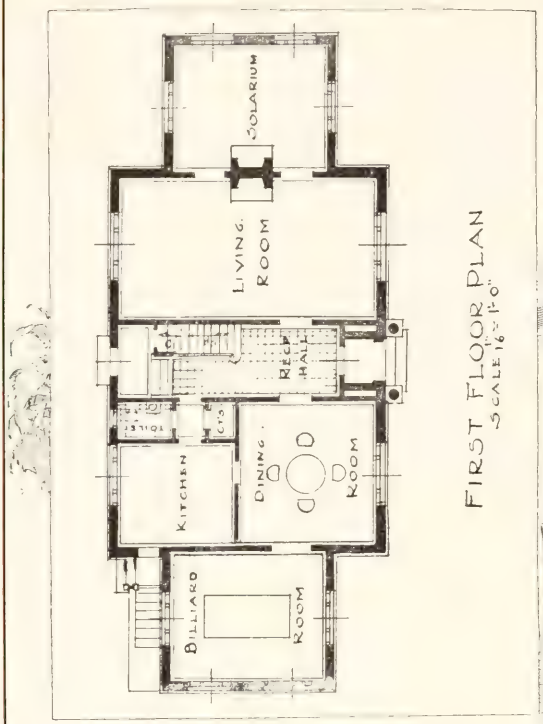

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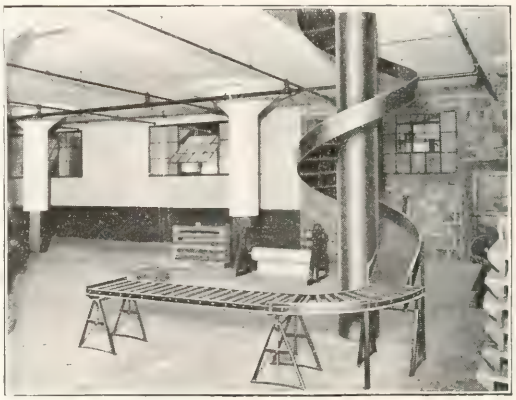

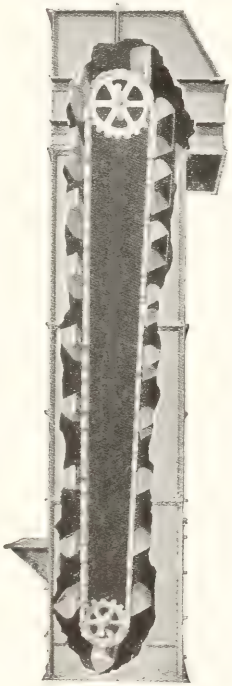

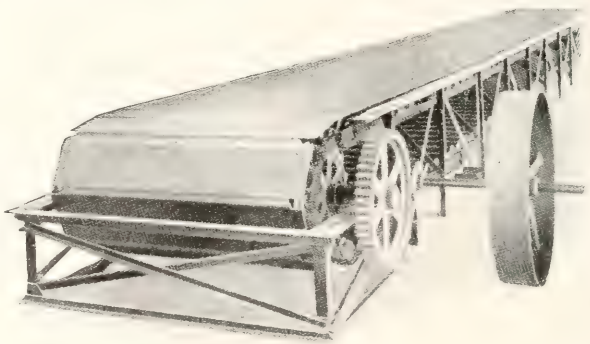

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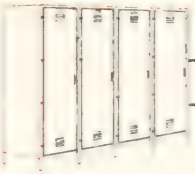

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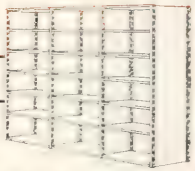

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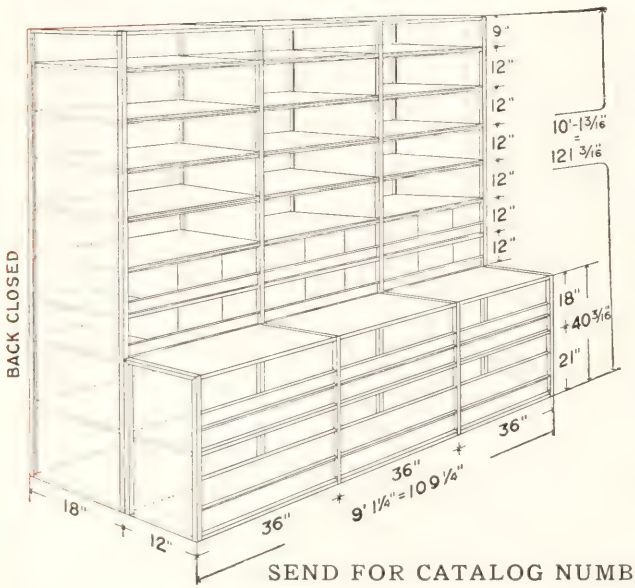

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Incorporated June 25, 1897

EDITORIAL

By EMERY STANFORD HALL

THE ARCHITECTURE OF AN ARCHITECT

PRELIMINARY STUDY

The architecture of an architect like the architecture of anything else is something which needs careful preliminary study. Is it strange that after a workman has seen an architect moving about a structure, making a change here, giving an order there, and everywhere receiving the, at least outward, respect and consideration of both foremen and contractors that he does not conclude that an architect's life is one greatly to be desired?

To the man who has always lived a subordinate life a peculiar halo seems to attach to authority. Never having tested authoritative responsibility he is unable to sense the painful side of responsibility. To him to command means peacock-like to strut and prene. His is no conception of the sleepless nights and ceaseless anxiety of one properly in authority. To him, running seems easy, where others walk with fear and trembling. Small wonder that the ambition of the building mechanic is often that his son instead of following in his father's footsteps shall become an architect and thus occupy a position where, as he conceives it, there is no work but only unlimited authority.

Not very different is the view of the contractor who sees the architect as a drawer of lines and an issuer of certificates for payment. Why! all that an architect has to do is to sign certificates and the Owner pays them. Could anything be easier? Perhaps he views the architect as merely a passer-out of jobs. How fine it would be if my son were an architect. He would then be in a position to give me all the jobs I should want and of course he always would be ready to issue a certificate in my favor and in any amount I might desire. Such a thing as fixed days for the issuance of certificates and required contractors' statements would be entirely done away with, if my son were an architect. True, architects are always poor. That is because they do not have contractors for fathers. If they did why of course they would get the jobs just the same and father would show them how to run the office. There would be no need of revised, re-revised and re-revised sketches and plans. Father knows how to draw plans. He is more competent than any architect. There would be no need of wasting time around the building on inspection work. Father's work is always right and father would have all of the jobs. Instead of son spending all of his commission in doing the work he, with father's advice, could save all of his commission. Therefore father's ambition is that son may become an architect, not a contractor. Possibly he conceives this might give his son more social standing. Never mind financial jeopardy—"Pa'll take care of the freight." Such notions on the part of those engaged in building, accounts for the large volume of material from this source offered for the construction of architects.

Why is the architect's son not interested in architecture? Why is he not offered as material? In the first place, due to observation incident to growing up in an architect's family, the architect's son knows that, at least from a financial standpoint, architecture is not all that could be desired. The same conclusion is likely to be reached by the young people in the home of any professional man; thus, is cut off the best source of supply for professional material. Heredity, breeding, associations, all point toward the advantage of succession. The professional view point is common in practically all of the great professions; architecture, law, medicine, theology, engineering. There is not nearly the shock in transfering from one profession to another that there is due to transfering from the trades and business to the professions.

It seems impossible that a son could grow up in the normally intimate association with a father competently engaged in any walk of life without subconsciously acquiring some of the father's skill.

The material offered for architecture is not all that could be desired. In any walk of life it never is. Falsely preconceived notions on the part of human material usually unfits that material for service. Likewise, lack of those peculiar personal qualifications which are essential to success. Notions may be changed, though the task is not an easy one. Faulty natural qualifications can not be made perfect. Men are born to function in certain avocations in life with greater success as well as greater pleasure to themselves than in any other. Let a man find his natural heritage be it in the mechanical arts, be it in business or be it in the professions, with diligence he will both find happiness and render a great service to the community in which he works.

With these facts clearly understood there should be no question as to the duty of the family, of the school and of the state to help young people to find the correct nitch in which to work. In order to protect itself the state must be diligent in the selection of its professions. Not only must it be diligent but it must also be very wise. A good architect may be spoiled in making a very poor doctor and the converse.

A clever resourceful contractor may be made into a crude dreamless architect whose monstrosities shall curse the community for endless time.

Possessed of erroneous notions as to the essential natural qualifications paramount to success in any particular calling the individual is unable to choose intelligently.

It is therefore an obligation of the experienced members of each profession to define as carefully as may be to prospective entrants, those natural qualifications that are needful to success in that profession. The qualified owe this as a duty to their own community as well as to the profession which they represent.

No man can obtain the education required for competent professional practice without sustaining an obligation to the state. No student pays the cost of his education at the time he is acquiring that education. The state or the community invests money in his education because it expects that later on in life he will return the investment with the interest in the form of service to society and to the state.

MATERIAL

Material out of which competent architects can be made must be composed of men of sound bodies and normal mental acuteness. There should be a smoothly running balance wheel which will neither permit arrogance or servility, the ability to command and be kind—the ability to judicially decide, and the character to enforce willing acceptance of correct decisions made. Quali-

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fications of leadership are born in a man but as good apples are subject to decay so bad training may spoil the best executive material.

Qualifications of leadership without a knowledge of where to lead is like a ship upon the sea without a destination. The architect should have natural mechanical insight. He must be able to visualize the obvious from the mechanical elements involved. He must always be able to see the fundamental controlling factor. Since he must pass on the work of numerous mechanical specialists he must, no matter how deeply hidden in special technical minutia, have the faculty of quickly getting at the fundamentals. Multitudinous details which he cannot hope to memorize but which he can always judge by tracing to the fundamentals involved, require that he must have a keen sense of the elements of physics—the lever, the wheel and the inclined plane. Also the essential principles of hydraulics. The too detailed mind cannot deduce because it gets lost in the endless accessories of minutia.

The architectural mind is primarily the diagnostic mind. It is its function to locate the trouble and to assemble the specialists to solve the problem. As such, of men, the architect must be an accurate judge. He must be quick to recognize peculiar ability and have the will, power and tact to bend that special skill to his purpose. He must know how to quickly detect a cantankerous spirit and to be able to check and control that spirit or else keep it from entering the building organization over which he is Commander-in-Chief. No man, no matter how greatly skilled in his special trade, has any place in a building organization who does not know how to do team work—to make a sacrifice hit once in a while for the good of the project. It is up to the Captain, meaning the architect, in this case, to see that no "player to the gallery" is selected as part of his building teams.

The architect must be a quick analyst possessed of the ability to enter a functioning building and detect almost at once the elements of clash and discourse in its operations; to run down the trouble and remodel or build anew so as to make the building perform its function with the least amount of material waste and the greatest economy and efficiency as well as with the least human waste or discomfort. After all, in the last analysis, buildings are only to serve the purpose of man. Buildings are to house and facilitate the manufacture of more and better product, to give men the physical comfort and facilities which shall make them live longer, be more useful, and add greater joy and worship than would be possible without them. The raw material must have—

First: For long hours of concentration, for the ability to absorb the infinite ramiarchitect should have natural mechanical inwork for days, yea even for weeks, without cessation neither day nor night, there is needed a physique which can stand such stress without breaking or making its wants so obstrusive as to induce abstraction from the problem in hand. Let the physical weakling stay out of architecture, no matter how much his ability otherwise.

Second: Mathematical facility, since this is the fundamental element of all logical analysis, an ability which has already been deduced as being the essential qualifications of the mind of an architectural possibility.

Third: More than all the qualifications thus far set forth there is need of the qualification of spiritual insight, as well as dream power facility. There is no need for anyone in architecture that has not vivid imaginative resource; that sort of graphic imagination that, after analyzing necessity and clothing with beautiful form and color, can close the physical eye and see the completed dream vision, not only in the essential beauty of the building but occupied by people and performing its proper function,—ability to dispassionately analyze that dream creation, note its defects, and devise ways and means of correcting the same.

Fourth: Skill in draftsmanship or the power of depiction. Notable ability is lost without a language. Every architect must have natural graphic skill. It is his best means of forceful presentation. Natural graphic skill is not the ability to learn to do trick drawing but natural ability with the hand to depict that which the brain has logically conceived.

Real draftsmanship always interprets three dimensions. The curse of the profession is the two dimension draftsman. The man who knows not descriptive and yet is clever with lines—lines that mean nothing to themselves or anybody else—lines that deceive because they are cleverly drawn.

Clever line drawers and wash placers get away with murder in architecture because they are clever. They are like clever talkers in medicine; one does not visualize the human body in the discharge of its functions the other does not visualize the building with its living, moving, acting human content.

To one the whole world is nothing but lines, possibly beautiful lines, but lines none the less. The other thinks the world is nothing but words, possibly well rounded, beautiful words, but words just the same. To the word medic the heart is not a thing of blood and muscle that functions—an engine that must never stop so long as life shall last—a thing that must be nursed and petted, stimulated and retarded but never stopped. It is just something that may be talked about. Talk may be with beautiful diction but without saying something it is sound that is all.

Finally summing up: Architectural material should be selected on fact not preconceived notions. It should be selected with care with a full knowledge of functional requirements. It is the duty of the experienced to help the inexperienced. The subject must have embryonic qualifications of leadership, visualizing power, a natural sense of orderly procedure and ability to sense function, to reason from cause to effect, man judgment selective ability, a charitable but compelling will, a quick accurate analytical sense, dream power and the ability to depict.

PREPARATION

The choicest material may be spoiled in preparation. Perfect steel can be burned in tempering. The value of a diamond is not surely known until after cutting.

To attain the highest development the young child should be taught to see and detect accurately. In the games of youth he should have the opportunity to develop leadership qualifications. His technical education should be founded on broad cultured background. He should know human life if he would minister to its needs. How better can he get that knowledge than by a study of the history of the civilization of the ages.

A young man about to enter the profession of architecture, one of the oldest in history. To live up to his calling he must be a man of learning, also his social qualifications should be carefully developed. How else can he know men's needs, select men and lead them in a constructive way. As early as possible he should have opportunity for structural observation. A chance to labor with a construction crew is not to be despised. If the young man has the power of observation he will gain most thereby.

With the foundation well laid in broad culture the standard technical school is well equipped to handle elementary technical training. The technical schools are blamed

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for much for which they are not responsible. Men are sent to these schools without adequate preparation. What is needed is an increase in the entrance requirements to the schools. Why should architecture, which has greater need for culture, have less cultural school entrance requirements than medicine? With a pre-medic course of two to four years of liberal arts, men are in most cases permitted to come directly from the high school and academy to architectural training. What ought to be done can be done. What is needed is the solid backing of the profession.

Where the chief defect in architectural training lies, is not in the school, but in the so-called practical experience which follows the school. That work which corresponds to the doctor's interneship in the hospitals. The young interne is switched to every kind of medical and surgical work, and yet there is complaint from physicians that the internes get more surgical than medical cases and there are some among the medical profession who insist that after the interne has finished his required work in the hospital he ought to have some experience with a general practitioner of medicine.

In the architect's office the interne works for wages and in many cases really gets no training at all. Of necessity he is put and kept on the one thing that he could do best when he entered the office. He learns better how to do that thing which he already knew how to do, but little else.

Complaint is frequently lodged as to the severity of architectural examinations. The trouble is not with the examinations. Architectural examinations are nowhere near as severe as the medical examinations although only about 20% of the candidates for the architectural examination pass where about 80% of the medical candidates pass. Professional entrance examinations are necessarily practical examinations and the young architectural candidates have usually had no practical experience except on one of the numerous subjects that are involved in the everyday practice of an architect. Few men come to the examination with any outside experience. Some have had all of their experience on structural design, some exterior design, some interior designs, few have had adequate training in the science of plan. Most of the applicants have not the faintest idea of how to go about the essential preliminary research preparatory to the careful study of the plans for a project. Even some of the men who come up for Senior Examination, after ten years' experience, are ignorant on how to make independent study of a plan problem. In other words their examination proves, that the success which they have attained, has been made possible only by their adeptness in stealing other men's brains. When a problem comes up in their practice which is new to them, if they cannot find anything published to copy, they find themselves at their wits' ends. Others gain by their experience after entering practice. Such experience gain being at the expense of their clients and of the public.

Incompetency on the part of any professional cheapens and adds contempt to that entire profession; yes even to professionals as a class.

CONSTRUCTIVE

Steps ought to be taken:

First: To insure adequate cultural foundation preliminary to a technical course.

Second: To support the technical school in the presentation of a well rounded, even balanced technical course which shall thoroughly ground the young architect in the elemental principles of design; give him facility in presentation and imbue him with structural sense.

Third: Some method by which the embryo architect can secure adequate practical experience in the practice of the various functions of an architect, including work in the preliminary research incident to a study of the problem, preliminary plans, preliminary design, general drawings, specifications, contracts and the supervision of construction. A carefully planned experience covering this broad field should, at the end of three years, after having completed a technical course, leave the young man adequately prepared to undertake the architectural entrance examination with reasonable assurance of success.

LUMBER

Lumber is one of the most important commodities which the Architect uses. For many years, diversified practice in grading and sizing has made it impossible to put the purchase of lumber on a sound business basis. There were literally hundreds of local, district and regional associations which promulgated and published grading rules. At one time it was said that if the lumber delivered by a retailer was condemned under one grade ruling, he had only to turn to some other grade ruling to prove that the material furnished was up to specifications.

OFFICIAL STANDARD GRADING RULES FOR LUMBER

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This is the first time this material has been published in a connected, consecutive manner—in a way so that the ordinary layman can see the connection between the General Standard Rules and the Special Rules required for peculiar species. It should be clearly understood that the General Standard Grading and Sizing Rules are basic and apply to every species of lumber manufactured anywhere in the United States. The species rules are simply supplementary to these general rules and apply only to the particular species to which they refer.

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Let the consumer beware when he is offered ungrade marked lumber with the statement that it is just as good as grade marked lumber and that the reason it is cheaper is because of the expense of grade marking. There is nothing to that argument—it is just plain bunk. Look deep for another cause—it is there somewhere.

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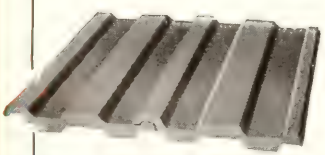

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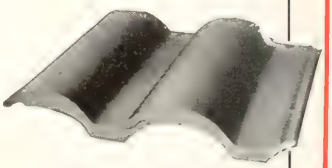

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CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested: he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordnates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics.

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safe guarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is cre ated. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act: by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary

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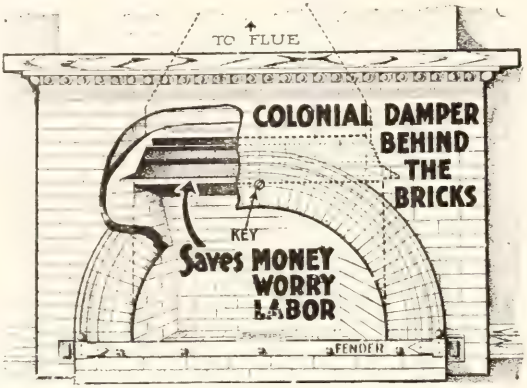

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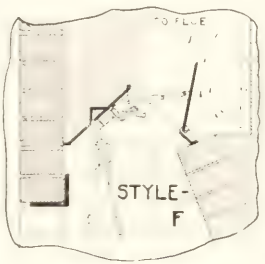

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sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

V.—On the Architect's Charges.

The schedule of charges of the Illinois Society of Architects is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing needless expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form any trade partnership or agreement with any person or firm connected therewith:

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nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: if he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To under value and cheapen his service or to compete where a just award is not safe guarded is inconsistent with this position. Competitions are undesirable from the standpoint of both the client and the architect and a member of of the Association should discourage the holding of same. If a competition becomes inevitible, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of Another.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of

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his ability by instruction and advice. An architect, should, as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the society cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Illinois Society of Architects as a general guide, yet the enumeration of particular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.

2. To guarantee an estimate or contract by bond or otherwise.

3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.

4. To advertise in any form.

5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.

6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.

7. To attempt to influence the award of a competition.

8. To injure intentionally the fair reputation, prospects or business of another architect.

9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.

10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.

11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.

12. To offer or perform services at rates lower than those approved as minimum by the Illinois Society of Architects in an attempt to supplant or underbid another architect.

13. To act in a manner detrimental to the best interests of the profession.

SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE ILLINOIS SOCIETY OF ARCHITECTS

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge is six per cent (6%), based upon the total cost of the work complete.

In case of the discontinuance or abandonment of the work, the architect's charge shall be based upon an *estimated* total cost, which estimated total cost may be determined by the architect, by experts, or by the lowest bids of responsible contractors. *Total cost* is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.

"STEELCRETE"

FOR MODERN BANK VAULT PROTECTION

Developed for and used in the largest vault in the world
The New York Federal Reserve Bank
Also installed in many Chicago District Banks

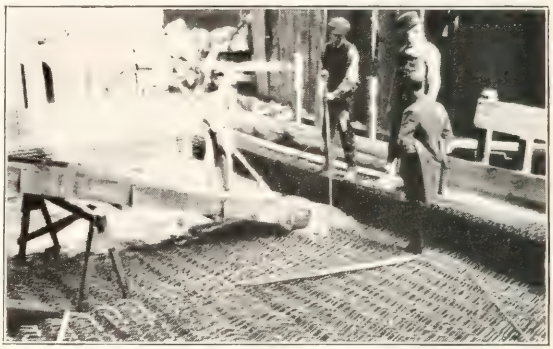
THIS modern system of vault protection is applicable to all banking institutions, large and small.

It consists of an enmeshment of Steelcrete embedded in concrete.

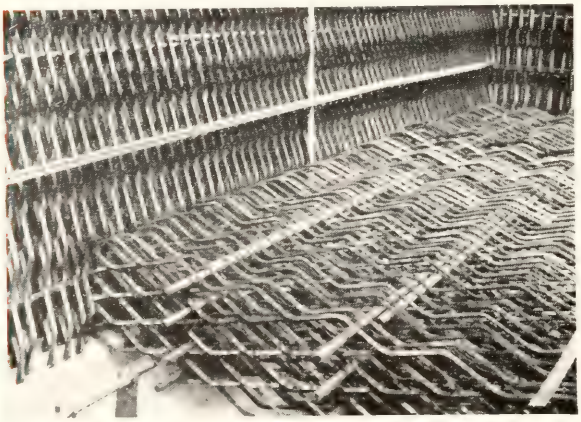
It resists explosives by the enmeshment of steel.

It resists the cutting flame by the monolithic mass of concrete.

It resists edged tools by the combined tenacity of meshed steel and concrete.



A Steelcrete Floor Mat being embedded in concrete. Note density of steel. Horizontal System.



The Vertical Steelcrete System showing interlocking of wall and floor sheets.

A few banks in which the vaults are protected with STEELCRETE

Lincoln Trust & Savings Bank, Chicago—Hall, Lawrence, Ripple & Ratcliffe, Architects, Chicago.

Jackson Park National Bank, Chicago—Wm. P. Doerr, Archt., Chicago.

First National Bank, Elkhart, Ind.—John A. Armstrong, Archt., Chicago.

Potters National Bank, East Liverpool, O.—Weary & Alford, Archts., Chicago.

First National Bank, La Grange, Ill.—Fugard & Knapp, Archts., Chicago.

Suburban Trust & Savings Bank, Oak Park, Ill.—Hall, Lawrence, Ripple & Ratcliffe, Archts., Chicago.

Western National Bank, Chicago, Ill.—H. E. Stevens Co., Archt., Chicago.

Homewood State Bank, Homewood, Ill.—Emil J. Liska, Archt., Chicago.

North Avenue State Bank, Milwaukee, Wis.—Brust & Phillips, Archts., Milwaukee.

Wabash National Bank, Wabash, Ind.—McGuire & Shook, Archts., Indianapolis, Ind.

Also five Federal Reserve Banks.

The Consolidated Expanded Metal Co.'s

1234 West Washington Boulevard

Steelcrete
TRADE MARK REGISTERED

CHICAGO ILLINOIS

2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

Preliminary Studies	.2
General drawings	.3
Specifications	.1
Scale and full size details	.1
General Supervision of the work	.3
Total	1.00

Fee for complete services as agreed, or see paragraphs 1 and 12.

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, elevations of all the fronts, such general vertical sections as may be necessary to elucidate the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-the-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

12. Exceptions.

Dwellings costing less than $10,000	10%
Lofts not requiring special planning for machinery or arrangement	5%
Additions and alterations to dwellings	12%
Additions and alterations to business buildings	10%

N. B.—Above schedule is considered minimum for ordinary and usual professional service. It is not considered fair or reasonable for highly specialized service.

Balsam-Wool

For Heat and Sound Insulation

NOTE: A series of Technical Sheets giving complete information on Balsam-Wool have been published. These show its efficiency as compared with other insulating materials and contain standard specifications. These sheets will be sent on request.

What Balsam-Wool Is

Balsam-Wool Standard Building Insulation is a blanket form of heat and sound insulation. It is made of wood fibres in fleecy wool form permanently matted together between two sheets of asphalt-coated tough Kraft paper.

For sound absorption, as distinguished from sound transmission, Balsam-Wool is also made in another form known as Balsam-Wool Sound Absorbent.

The Qualities of Balsam-Wool

There are two factors responsible for the high efficiency of Balsam-Wool as a heat insulator: namely, the materials used and the manner in which they are put together. A wood product, Balsam-Wool takes advantage of all the natural heat resistance of wood multiplied many times by a rearrangement of the cellular wood fibres into a "wool" form which retards the circulation of air in the air cavities. The fact that the paper liners on Balsam-Wool are NOT STITCHED or punctured in any way adds further to its resistance to the passage of both heat and moisture.

The ability of the wool in Balsam-Wool to absorb sound and the tendency of the paper covering to reflect sound waves accounts for its remarkable efficiency as an insulation against the transmission of sound.

The water-proof film of asphalt with which the paper coverings are lined protects the wool from moisture and thus assures its high insulating efficiency.

In the manufacturing process the wool in Balsam-Wool is chemically treated to make it fire-resistant.

Balsam-Wool does not attract or harbor rats, mice or vermin. Balsam-Wool does not contain animal matter. It is clean, odorless and sanitary.

Once in place in a building Balsam-Wool is there to stay. It cannot sift or settle because each fibre is coated with an adhesive which cements it to adjacent fibres. The asphalt coating provides a permanent bond between wool and paper.

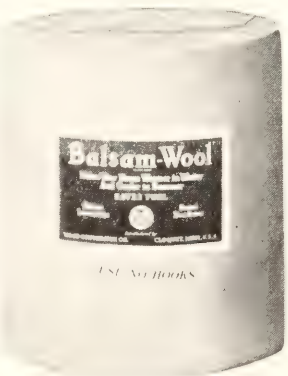
The three standard widths in which Balsam-Wool comes meet all average building construction requirements. Thus the carpenter cuts only to length. The fact that Balsam-Wool is light in weight and easily handled and installed, speeds up the work and keeps the cost of installation low.

Standard Form of Balsam-Wool

For heat insulation and sound deadening in buildings and for heat insulation in household and commercial refrigerators Balsam-Wool comes in one standard form. The wool is covered on each side with asphalt-coated, tough paper liners of No. 1 kraft.

Standard Sizes

Balsam-Wool for building insulation comes in three standard widths, 17″, 25″ and 32″. There is only one standard thickness, ½″. Balsam-Wool can be obtained, however, in 1″ thickness on special order. It is delivered in standard packages, rolled, wrapped and sealed, 250 square feet to the package.



Balsam-Wool is a Weyerhaeuser product. It bears the name of an organization that for more than sixty-five years has been known for the high standard of quality maintained in all its products.

Balsam-Wool Standard Building Insulation is distributed through retail lumber dealers. Any retail lumber dealer can obtain a supply promptly.

WOOD CONVERSION COMPANY

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CHICAGO OFFICE, STRAUS BLDG., Room 1849
Phone Harrison 1847

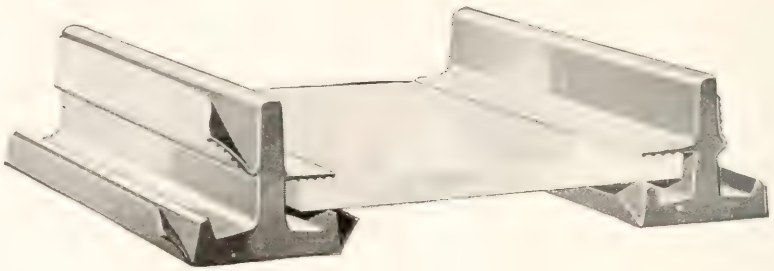
LIST OF LICENSED ARCHITECTS

Members of the Profession who will be Permitted to Practice in the State of Illinois.

Every means has been used to get a correct List of Licensed Architects who are permitted to practice Architecture in the State of Illinois for the ensuing year. The names have been compared with the Official Records of the State of Illinois.

CHICAGO

Aarens, Harry B., 1000 Argyle St.
Abell, Lester A., 6928 Oglesby Ave.
Abbott, Frank B., 5172 W. North Ave.
Ablamowicz, Sigmund V., 1859 W. Chicago Ave.
Aga, O. W., 104 S. Michigan Ave.
Ahlschlager, Walter W., 65 E. Huron St.
Allen, Alfred P., 225 N. Michigan Ave.
Allen, James Roy, 410 S. Michigan Ave.
Allerton, Oscar J., 541 W. Adams St.
Allison, Lyman J., 115 S. Dearborn St.
Almquist, Carl M., 118 N. La Salle St.
Alschuler, Alfred S., 28 E. Jackson Blvd.
Anderson, Edwin F., 2015 Howe St.
Anderson, Helge A., 3116 Sunnyside Ave.
Anderson, Russell A. M., 612 Sheridan Rd.
Anderson, William C., 5431 Harper Ave.
Angell, Arnold A., 825 Cornelia Ave.
Anis, Albert, 64 W. Randolph St.
Ansel, Anton, 5047 Cullom Ave.
Archer, Chas. S., 6222 Cottage Grove.
Armstrong, John A., 127 N. Dearborn St.
Ashby, George William, 1511 W. Jackson Blvd.
Ashby, Wilbert B., 1511 W. Jackson Blvd.
Bacon, James Earl, 7332 Phillips Ave.
Bailey, Walter T., 3621 S. State St.
Bannister, George S., 115 S. Dearborn St.
Barfield, William G., 58 W. Washington St.
Bargman, Ewald F., 1408 Jarvis Ave.
Barnum, George L., 1614-134 S. La Salle St.
Barrett, Fred L., 4411 N. Kedzie Ave.
Barry, Gerald A., Jr., 4929 Augusta St.
Barthel, Bernard, 127 N. Dearborn St.
Barton, F. M., 3426 S. Kedzie Ave.
Beach, Wilfred W., P. O. Box 1254.
Bean, Ralph H., 111 W. Monroe St.
Beaudry, Ralph L., 1444 E. 65th St.
Beck, H. Frederic, 159 Ontario St.
Beck, Willis J., 4720 N. Racine Ave.
Bednarik, Jos., 5307 S. Rockwell St.
Beers, Herbert P., 53 W. Jackson Blvd.
Beersman, Chas. G., 2045 Sedgwick St.
Behrns, Elmer F., 605 N. Michigan Ave.
Beiler, Henry P., 910 S. Michigan Ave.
Bein, Maurice L., 64 W. Randolph St.
Bellas, Charles, 104 S. Michigan Blvd.
Beman, Spencer S., 108 S. La Salle St.
Bendus, William Quincy, 332 S. Michigan Ave.
Bennett, A. J. T., 38 S. Dearborn St.
Bennett, Edward H., 1800-80 E. Jackson Blvd.
Bennett, Wm. Arthur, 35 N. Dearborn St.
Benson, Arthur E., 5153 N. Clark St.
Benson, Edward, 5153 N. Clark St.
Bentley, Harry H., 343 S. Dearborn St.
Berlin, Robert C., 19 S. La Salle St.
Bernard, Clifford S., 7554½ Coles Ave.
Bernham, Felix M., 4623 Drexel Blvd.
Bernhard, Wilhelm, 879 N. State St.
Betts, Wm. B., 155 N. Clark St.
Bialles, Theo. P., 3759 N. Kedvale Ave.
Bicknell, Alfred H., 3801 N. Hoyne Ave.
Bieg, Harry K., 4822 N. Winchester Ave.
Bischof, Jacob H., 2635 Hampden Court.
Bishop, Thomas R., 35 S. Dearborn St.
Bjork, David T., 123 W. Madison St.
Blondin, Edward A., 5 E. Garfield Blvd.
Blouke, Pierre, 80 E. Jackson Blvd.
Bodholdt, Arne, 104 S. Michigan Ave.
Bollenbacher, J. C., 332 S. La Salle St.
Bouchard, Lewis C., 30 N. Dearborn St.
Bourke, Robt. E., 39 S. La Salle St.
Bowen, Howard, 549 W. Washington St.
Braband, Frank J. E., 901 Wrightwood Ave.
Brabant, Gifford, 2717 N. Kedzie Ave.
Brand, Herbert A., 510 N. Dearborn St.
Brandt, Robert, 1441 N. Washtenaw Ave.
Braucher, Ernest N., 10 N. Clark St.
Braun, George, Jr., 2619 N. Lawndale Ave.
Braun, Isadore H., 19 S. La Salle St.
Braun, Wm T., 58 E. Washington St.
Bright, Jasper T., 155 N. Clark St.
Bristle, Joseph H., 5 N. La Salle St.
Britton, Frank, 817 W. 70th St.
Brown, Arthur Geo., 134 N. La Salle St.
Bruns, Benedict J., 726 Hastings St.
Brydges, E. Norman, 5 N. La Salle St.
Buck, Lawrence, 64 E. Van Buren St.
Buckett, Arthur C., 936 N. Michigan Ave.
Budnia, Adolph O., 212 E. Superior St.
Buerger, A. J., Jr., 5312 W. Chicago Ave.
Bullock, Edwin C. A., 190 N. State St.
Burgess, Ralph R., 1923 Calumet Ave.
Burnham, Daniel H., Jr., 160 N. La Salle St.
Burnham, Hubert, 160 N. La Salle St.
Burns, James, 64 W. Randolph St.
Burt, Henry J., 1400-104 S. Michigan Ave.
Burt, Paul Gordon, 219 E. Superior St.
Byrne, Francis B., 104 S. Michigan Ave.
Cabeen, Richard McP., 1400 Monroe Bldg.
Cable, Max Lowell, 415 N. Western Ave.
Caparo, Alexander V., 7 S. Dearborn St.
Carlson, Richard J., 1617 Berwyn Ave.
Carnegie, Wm. G., 6 N. Clark St.
Carey, James L., 208 N. Laramie Ave.
Carpenter, Martin R., 72 W. Washington St.
Carr, Charles Alban, 1960, 160 N. La Salle St.
Carr, George Wallace, 122 S. Michigan Ave.



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Nothing but imperishable lead and glass exposed to the weather. Greatest glass area and strength of any metal skylight. Superior in quality to any sheet metal. Competitive in prices with the best.

Everlasting—

Never rusts or rots.
No packing to dry out.

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Any Sheetmetal Man can set STEELEAD Skylights.

Never Drips—

Condensation perfectly drained off by especially designed gutters.

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Lead joints defy wind, sun, rain, frost, snow.

Complete, Ready-to-Set

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Sidewalk Doors and Coal Hole Covers
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Cauley, Frank William, 7710 N. Marshfield Ave.
Cerny, Jerry J., 1444 S. Crawford Ave.
Cerny, Otto F., 77 W. Washington St.
Charles, Walter E., 155 N. Clark St.
Chase, Frank D., 720 N. Michigan Ave.
Chatten, Melville C., 160 N. La Salle St.
Cheney, Howard Lovewell, 208 S. La Salle St.
Childs, Frank A., 720 N. Michigan Ave.
Christenson, C. Werner, 6582 Sheridan Road
Christensen, John C., 3255 Evergreen Ave.
Christiansen, Eli, 7047 Indiana Ave.
Christiansen, Roy T., 1624 Ainslee St.
Chubb, John D., 109 N. Dearborn St.
Clark, Edwin H., 8 E. Huron St.
Clark, Leslie Doane, 6233 Greenwood Ave.
Clark, Robert C., 7216 Harvard Ave.
Clark, Wm. Jerome, 836 S. Michigan Ave.
Clay, William W., 538 S. Dearborn St.
Cobb, William H., 5 N. La Salle St.
Coffin, Arthur S., 6 N. Michigan Ave.
Cohen, Isadore, 1505-53 W. Jackson Blvd.
Cohen, Joseph, 160 N. La Salle St.
Colcord, Albert E., 6143 St. Lawrence Ave.
Cole, Arthur W., 321 Tillson Pl.
Comm, Benjamin A., 20 W. Jackson Blvd.
Conner, George D., 3 E. Ontario St., Suite 23.
Cook, Norman W., 1283 Victor Ave.
Coolidge, Chas. A., 134 S. La Salle St.
Corse, Raymond O., 159 E. Ontario St.
Coughlen, Gardner C., 160 N. La Salle St.
Crane, Charles Howard, 127 N. Dearborn St.
Crosby, Wm. S., 6 No. Michigan Ave.
Crowen, Samuel N., 10 S. La Salle St.
Cummings, Raymond Henry, 1712 Juneway Terrace.
Dalsey, H. I., 2321 W. North Ave.
Davey, John Jeffrey, 1407 Manhattan Bldg.
Davidson, Frank E., 53 W. Jackson Blvd.
Davis, Zachary T., 400 N. Michigan Ave.
Dean, Arthur R., 137 S. La Salle St.
De Golyer, Robt. S., 307 N. Michigan Blvd.
Del Campo, Scipione, 2955 N. Kilpatrick Ave.
De Money, Frank O., 5 N. La Salle St.
Demuth, John J., 1950 Winnemac Ave.
Denell, Reuben A., 2248 Lunt Ave.
Dennis, Charles A., 4885 N. Ashland Ave.
Denson, James F., 720 N. Michigan Ave.
Dewey, Charles, 4804 N. Kedzie Ave.
Dibelka, James B., 2743 W. 22nd St.
Dillard, Frank G., 127 N. Dearborn St.
Dinkelberg, Fred'k P., 400 N. Michigan Ave.
Dippold, Albert P., 4651 Cottage Grove Ave.
Doerr, Harold F., 7 W. Madison St.
Doerr, Jacob F., 7 W. Madison St.
Doerr, Wm. Phillip, Jr., 7 W. Madison St.
Doerr, Wm. P., 28 E. Jackson Blvd.
Dougherty, Floyd E., 35 N. Dearborn St.
Dowling, Edward F., 646 N. Michigan Ave
Dranie, John G., 6748 Cornell Ave.
Drielsma, J. Arthur, 1359 Thorndale Ave.
Dubin, George H., 14 W. Washington St
Dubin, Henry, 14 W. Washington St.
Duckworth, John S., 20 W. Jackson Blvd.
Dunford, S. H., 104 S. Michigan Ave.
Dunlap, Francis E., 111 N. Dearborn St.
Dunning, N. Max, 310 S. Wabash Ave.
Durkee, Arthur R., 6359 S. Peoria St.
Dwen, Robert G., 8 E. Huron St.
Dyer, Scott C., 38 S. Dearborn St.
Eberson, John, 212 E. Superior St.
Eckstorm, Christian A., 5 N. La Salle St.
Ehresmann, Donald Robert, 435 N. Michigan Ave.
Ehmann, Wm. Frederick, 140 S. Dearborn St.
Eich, George B., 104 S. Michigan Ave.
Eichberg, S. Milton, 64 W. Randolph St.
Ellert, Frank J., 7 W. Madison St.
Elmslie, Geo. C., 122 S. Michigan Ave.
Erickson, Carl A., 104 S. Michigan Ave.
Ermeling, Ralph W., 58 E. Washington St.
Eskridge, Fred A., 6654 Stewart Ave.
Esser, Curt A., 38 S. Dearborn St.
Esser, Paul F., 5719 N. Hermitage Ave.
Fairclough, Stanley D., 820 Exchange St. U. S. Yards.
Falls, Alexander S., 50 N. La Salle St.
Farrier, Clarence W., 80 E. Jackson Blvd.
Faulkner, Chas. D., 309 N. Michigan Ave.
Fellows, Wm. K., 814 Tower Court.
Ferrenz, Tirrell John, 720 N. Michigan Ave.
Fielder, Fred A., 118 E. 26th St.
Finck, Sidney C., 1215 W. Madison St.
Fischer, F. Wm., 9129 Commercial Ave.
Fischer, John B., 140 S. Dearborn St.
Fisher, Albert J., 2001 Greenleaf Ave.
Fisher, Joseph G., 2001 Greenleaf Ave.
Fishman, M. Maurice, 11 S. La Salle St.
Flaks, Francis A., 1956 S. Springfield Ave.
Flesch, Eugene W. P., 5115 University Ave.
Fletcher, Robert C., 179 W. Washington St.
Flinn, Raymond W., 1412-8 S. Dearborn St.
Floto, Julius, 53 W. Jackson Blvd.
Foehringer, Frederick, 2672 Orchard St.
Fogel, R. W., 1839 Warner Ave.
Foltz, Frederick C., 510 N. Dearborn St.
Fortin, Joseph T., 600 Blue Island Ave.
Foster, Arthur, 225 N. Michigan Ave.
Foster Winslow H., 9238 Pleasant Ave.
Fournier, Lawrence A., 122 S. Michigan Ave.
Fox, Charles E., 1715 Tribune Tower.
Fox, Elmer J., 7324 Constance Ave.
Fox, John J., 38 S. Dearborn St.
Fox, William Paul, 38 S. Dearborn St.
Foy, Wm. D., 1400-104 S. Michigan Ave.
France, Roy F., 155 N. Clark St.
Franklin, Robert L., 160 N. La Salle St.
Frazier, Clarence E., 30 N. Dearborn St.
Frederick, Erwin G., 140 S. Dearborn St.
Friedl, Herman, 508 N. Dearborn St.
Friedman, Raphael N., 28 E. Jackson Blvd.
Frodin, Rube S., 808-30 N. Michigan Ave.
Frommann, Emil H., 64 W. Randolph St.
Frost, Charles S., 105 S. La Salle St.
Frost, Harry Talfourd, 1800 Railway Exch.
Fry, Frank L., 140 S. Dearborn St.
Fugard, John Reed, 219 E. Superior St.
Fullenwider, Arthur E., 646 N. Michigan Ave.
Fuller, Ravilo Franklyn, 6 N. Michigan Ave.
Fuhrer, Eugene, 1900-28 E. Jackson Blvd.
Furst, Wm. H., 127 N. Dearborn St.
Gallup, Harold E., 646 N. Michigan Ave.
Garden, Hugh M. G., 104 S. Michigan Ave.
Gardner, Horace C., 140 S. Dearborn St.
Gassman, Andrew P., 143 Lorel Ave.
Gatterdam, Fred E., 186 N. La Salle St.

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PYROBAR *Partition Tile*

Gypsum tile is the only structural material that has ever passed the Underwriters' Laboratories' fire and water test for fireproof partitions. Strong, light weight, a low conductor of sound and heat, this tile is ideal for partitions, furring, elevator enclosures, and steel protection.

PYROBAR *Reinforced Roof Tile*

Made of light, strong Structolite, this tile is unequaled for roof decking. Its high insulating quality saves fuel and stops condensation. It is resistive to smoke and sulphur fumes. It is quickly and economically erected in any kind of weather, can be adapted to any roof design or purlin spacing, and is ready for the immediate application of any roof covering.

PYROBAR *Precast Floor Voids*

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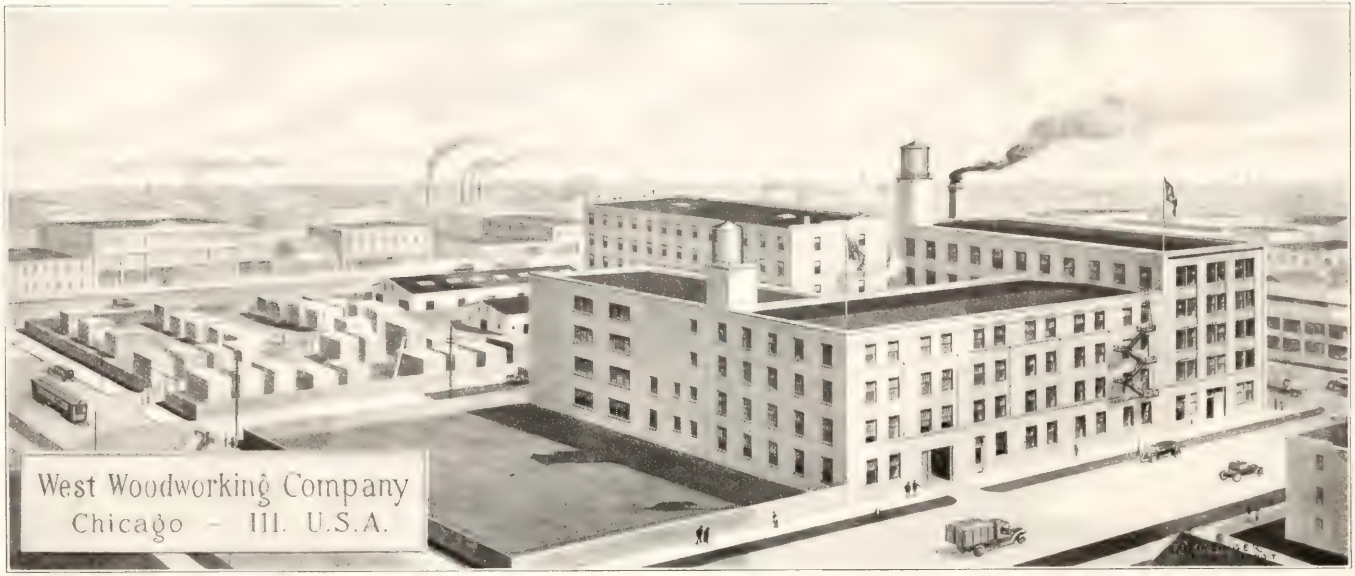

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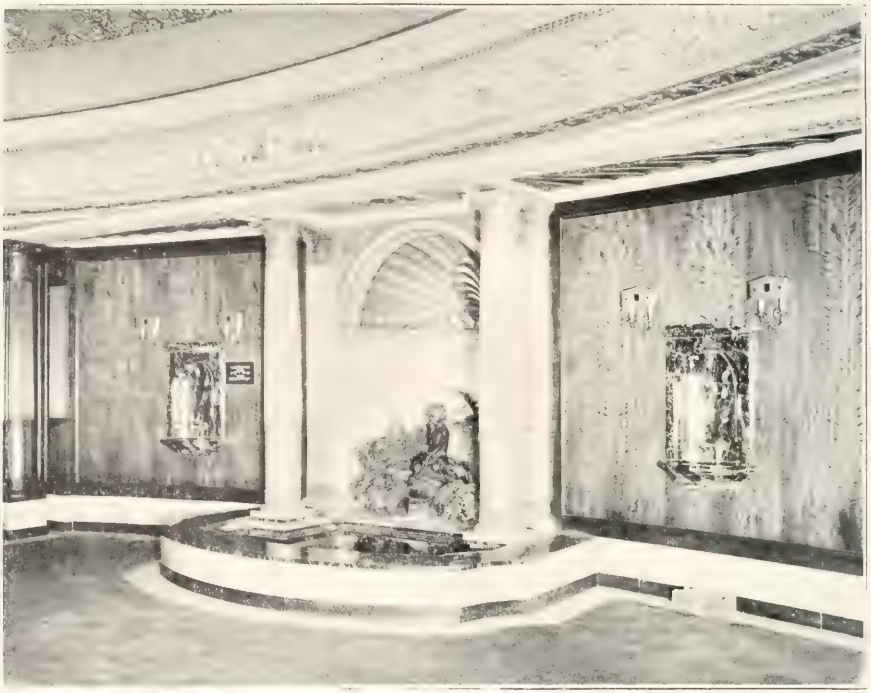

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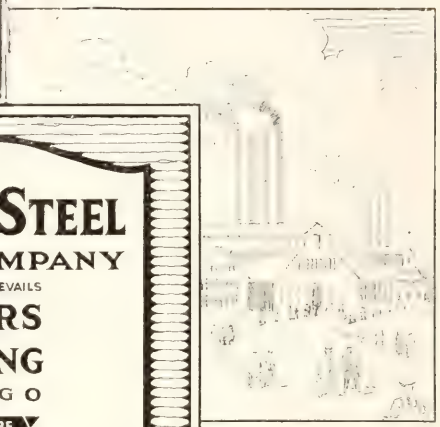

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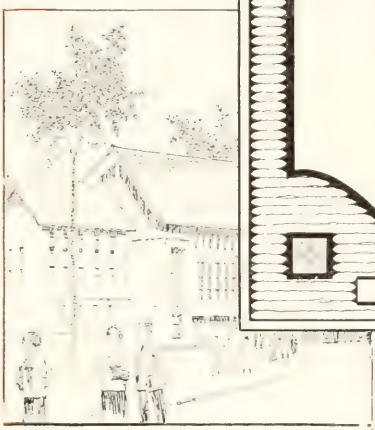

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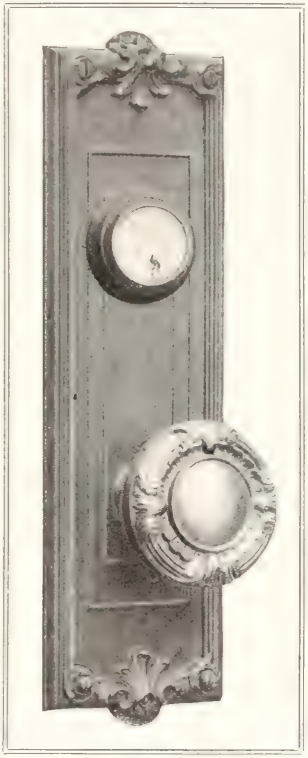

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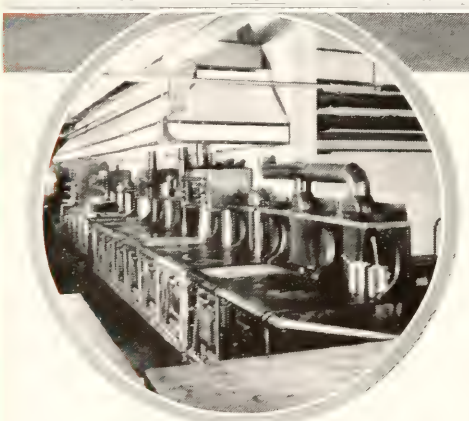

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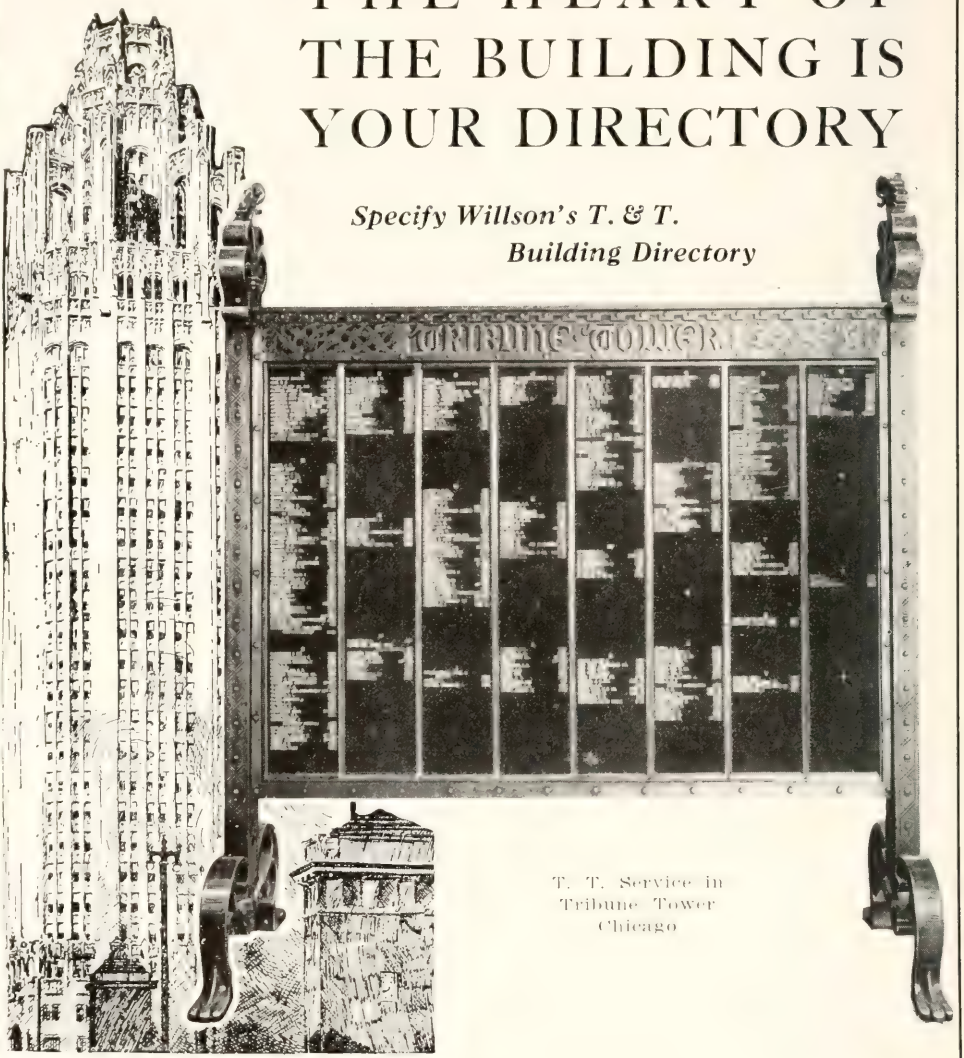

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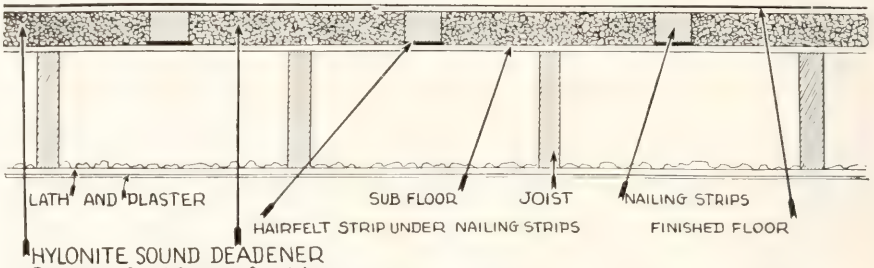

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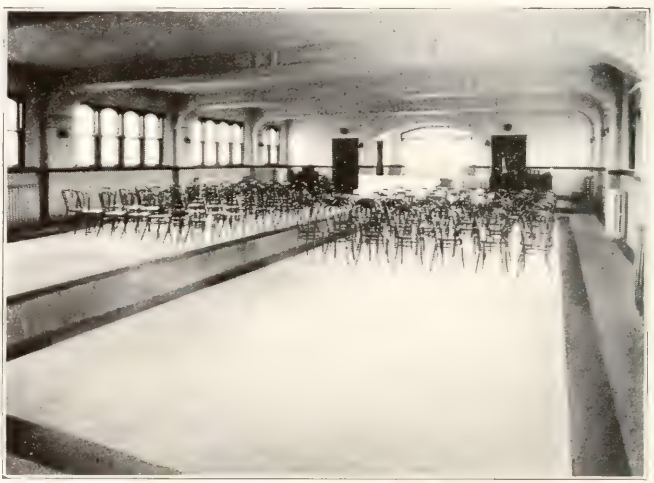

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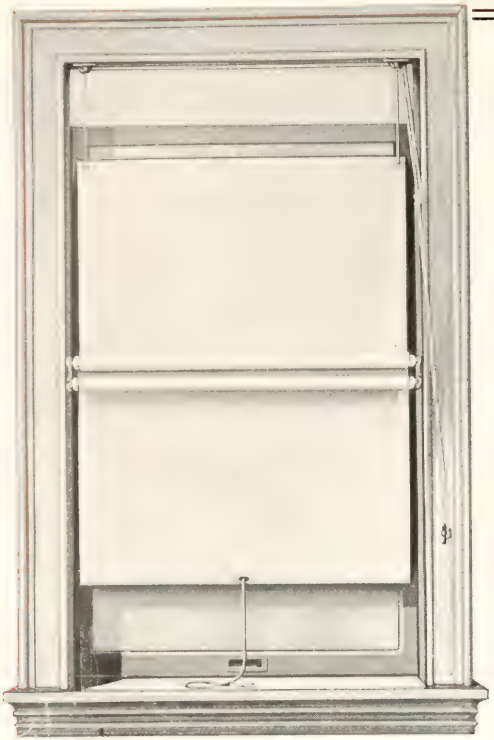

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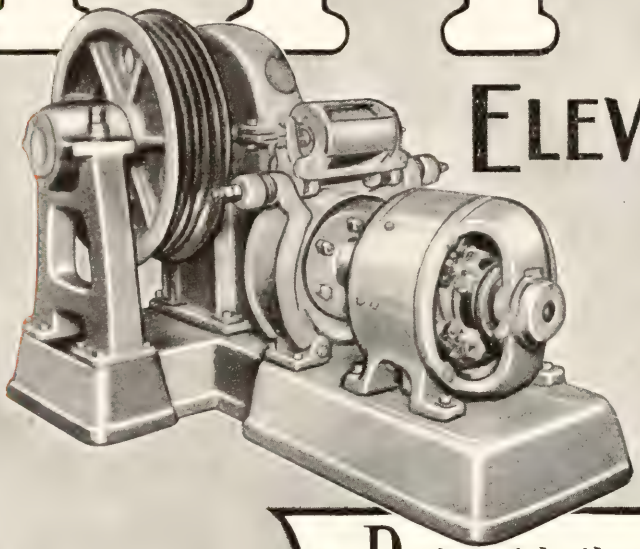

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"THE ILLINOIS ARCHITECTURAL ACT"

ARCHITECTS LICENSE LAW STATE OF ILLINOIS

For an Act to provide for the licensing of architects and to regulate the practice of architecture as a profession and to repeal certain Acts therein named.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: It shall be unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect duly issued by the Department of Registration and Education under this Act, and as provided for in the civil administrative code of Illinois.

Sec. 2. Any one, or any combination of the following practices by a person shall constitute the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

Sec. 3. No corporation shall be licensed to practice architecture in this State or be granted a certificate of registration under this Act, but it shall be lawful for a stock company or a corporation to prepare drawings, plans and specifications for buildings and structures as defined in this Act which are constructed, erected, built, or their construction supervised by such stock company or corporation, provided that the chief executive officer or managing agent of such stock company or corporation in the State of Illinois shall be a registered architect under this Act; And, provided, further, that the supervision of such buildings and structures shall be under the personal supervision of said registered architect and that such drawings, plans and specifications shall be prepared under the personal direction and supervision of such registered architect and bear the stamp of his official seal.

It shall be lawful, however, for one or more registered architects to enter into a partnership with one or more licensed structural engineers, licensed under the laws of this State, for the practice of their professions.

Sec. 4. Nothing contained in this Act shall prevent the draftsmen, students, clerks of works, superintendents and other employees of those lawfully practicing as registered architects under the provisions of this Act, from acting under the instruction, control or supervision of their employers, or to prevent the employment of superintendents of the construction, enlargement or alteration of buildings or any parts thereof, or prevent such superintendents from acting under the immediate personal supervision of the registered architect by whom the plans and specifications of any such building, enlargement or alteration were prepared. Nor shall anything contained in this Act prevent persons, mechanics or builders from making plans, specifications for or supervising the erection, enlargement or alteration of buildings or any parts thereof to be constructed by themselves or their own employees for their own use, provided that the working drawings for such construction are signed by the authors thereof with a true statement thereon of their relation to such construction and that the makers thereof are not architects.

Provided nothing in this Act contained shall be held or construed to have any application to any building, remodeling or repairing of any building or other structure outside of the corporate limits of any city or village, where such building or structure is to be, or is used for residential or farm purposes, or for the purposes of outbuildings or auxiliary buildings in connection with such residential or farm premises, nor shall said Act apply to any building remodeling or repairing of any building or structure within the corporate limits of any city or village, where the total cost of said building, remodeling or repairing does not exceed the sum of seventy-five hundred dollars.

Sec. 5. Any person who is twenty-one years of age and of good moral character is qualified for an examination for a certificate of registration as a registered architect, provided he or she has graduated from a high school or secondary school, approved by the Department of Registration and Education, or has completed an equivalent course of study as determined by an examination conducted by the Department of Registration and Education, and has subsequently thereto completed such course in mathematics, history and language, as may be prescribed by said Department, and has had at least three years' experience in the office or offices of a reputable architect or architects.

Sec. 6. Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another state or territory of the United States, or of foreign country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the followingg conditions:

(a) That the applicant is at least twenty-one years of age, of good character and temperate habits: and

(b) That the requirements for the registration or licensing of architects in the particular state, territory, county or province, were, at the date of the license, substantially equal to the requirements then in force in this State.

Sec. 7. Every person who desires to obtain a certificate of registration shall apply therefor to the Department of Registration and Education in writing, upon blanks prepared and furnished by the Department of Registration and Education. Each application shall be verified by the applicant under oath and shall be accompanied by the required fee.

Sec. 8. The Department of Registration and Education shall hold examinations of applicants for certificates of registration as registered architects at such times and places as it may determine.

The examination of applicants for certificates of registration as registered architects shall consist of written tests and shall embrace the following subjects:

(a) The planning, designing and construction of buildings.

(b) The strength of building materials.

(c) The principles of sanitation and ventilation as applied to buildings.

(d) The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

(e) The examinations of applicants for certificates of registration as registered architects, where the applicant shall have had ten or more years proved architectural practice as a principal in the practice of architecture as a profession, shall be by exhibits of preliminary studies, general drawings, specifications and detail drawings, prepared under the personal supervision of the applicant; by photographs of executed work and evidence of authorship, supplemented by a verbal quiz as to reasons for methods used and procedure shown and by proof of honorable practice, or by any or all of these, which in the judgment of the Examining Committee are necessary to determine the applicant's qualifications as an architect, which shall be equivalent to or superior in relative value to the requirements set forth in the preceding paragraphs of this section for an applicant having had less than ten years experience.

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The Department of Registration and Education may by rule prescribe additional subjects for examination.

Sec. 9. Whenever the provisions of this Act have been complied with by an applicant the Department of Registration and Education shall issue a certificate of registration to the applicant as a registered architect, which certificate shall have the effect of a license to the person to whom it is issued to practice architecture in this State, subject to the provisions of this Act.

Any license or certificate of registration heretofore issued under the laws of this State authorizing its holder to practice architecture shall, during the unexpired period for which it was issued, serve the same purpose as the certificate of registration provided for by this Act.

Sec. 10. Any person licensed to practice architecture in this State or registered as an architect under this Act shall be exempt from the provisions of any and all Acts in force in this State regulating the practice of structural engineering.

Sec. 11. Every holder of a certificate of registration as a registered architect shall display it in a conspicuous place in his principal office, place of business or place of employment.

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words "Registered Architect," "State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision. Any seal heretofore authorized under the laws of this State shall serve the same purpose as the seal provided for by this Act.

Sec. 12. Every registered architect who continues in active practice shall, annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year, shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five (5) years may have his certificate of registration renewed, at any time within a period of five (5) years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed annual renewal fees.

Sec. 13. The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following causes:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

The Department of Registration and Education shall not refuse to renew, nor suspend, nor shall it revoke any certificate of registration for any of the above causes until the person accused shall have been given at least twenty (20) days' notice in writing of the charge against him and a public hearing upon such charge has been had by the Department of Registration and Education.

Upon the hearing of any such proceeding, the Director of Registration and Education, the Assistant Director of Registration and Education, or the Superintendent of Registration may administer oaths, and the Department of Registration and Education may issue subpoenas and procure and compel the attendance of and the giving of testimony by witnesses and may compel the production of any books and papers deemed relevant to the inquiry by the Department or by the persons designated by the Department under the Civil Administrative Code of Illinois to conduct such inquiry. The accused may have the subpoena of the Department of Registration and Education for his witnesses, and may be heard in person and by counsel, in open public hearing.

Any circuit court, or any judge of a circuit court, either in term time or in vacation, upon the application either of the Department of Registration and Education or of the accused may, by order duly entered, require the attendance and enforce the giving of testimony of such witnesses and require the production of such books and papers as are above in this section referred to before the Department of Registration and Education or the persons designated by said Department under said Civil Administrative Code to conduct the inquiry in any hearing relating to the refusal, suspension, renewal or revocation of any certificate of registration. Upon refusal or neglect to obey the order of the said court or judge, the said court or judge may compel, by attachment or proceedings for contempt of courts, or otherwise. obedience to the order.

Sec. 14. The fee to be paid by an applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect shall be ten dollars ($10).

The fee to be paid by an applicant for a certificate of registration as a registered architect shall be five dollars ($5).

The fee to be paid for the restoration of an expired certificate of registration shall be five dollars ($5).

The fee to be paid upon renewal of a certificate of registration shall be one dollar ($1).

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, shall be fifteen dollars ($15).

Sec. 15. The Department of Registration and ducation shall adopt rules and regulations in accordance with the provisions of section 60 of said Civil Administrative Code, and not inconsistent with this Act, to carry out fully and enforce the provisions of this Act.

Sec. 16. Each of the following Acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars ($25) nor more than two hundred dollars ($200) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education of this State.

(b) The making of any willfully false oath or affirmation in any matter or proceeding where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings which have not been prepared by him or under his immediate personal supervision.

(d) The violation of any provision of Section 11 of this Act.

All fines and penalties shall inure to the Department of Registration and Education of this State.

Sec. 17. The Department of Registration and Education shall keep a record open to public inspection at all reasonable times of its proceedings relating to the issuance, refusal, renewal, suspension and revocation of certificates of registration. This record shall also contain the name, place of business and residence, and the date and number of regis-

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tration of each registered architect in this State.

Sec. 18. The following Acts are hereby repealed: "An Act to provide for the licensing of architects and regulating the practice of architecture, as a profession," approved June 3, 1897, and in force July 1, 1897, and the following Acts amendatory thereof, to-wit: An Act approved April 19, 1899, and in force July 1, 1899. An Act approved May 16, 1905, and in force July 1, 1905; and an Act approved May 26, 1911, and in force July 1, 1911.

Sec. 19. This Act may be known and cited as "The Illinois Architectural Act."

EXTRACTS FROM THE NEW CIVIL ADMINISTRATIVE CODE OF THE STATE OF ILLINOIS

Which Affects the practice of the Architectural Profession in this State

An Act in relation to the civil administration of the State government, and to repeal certain Acts therein named. [Approved March 7, 1917, in force July 1, 1917.]

GENERAL PROVISIONS.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: This Act shall be known as "The Civil Administrative Code of Illinois."

Sec. 2. The word "department," as used in this Act shall, unless the context otherwise clearly indicates, mean the several departments of the State government as designated in Section 3 of this Act, and none other.

Sec. 3. Departments of the State government are created as follows:

The department of finance;
The department of agriculture;
The department of labor;
The department of mines and minerals;
The department of public works and buildings;
The department of public welfare.
The department of public health;
The department of trade and commerce;
The department of registration and education.

Sec. 4. Each department shall have an officer at its head who shall be known as a director, and who shall, subject to the provisions of this Act, execute the powers and discharge the duties vested by law in his respective department.

Sec. 5. In addition to the directors of departments, the following executive and administrative officers, boards and commissions, which said officers, boards and commissions in the respective departments, shall hold offices hereby created and designated as follows:

In the Department of Public Works and Buildings.

Assistant director of public works and buildings;
Superintendent of highways;
Supervising architect;
Supervising engineer;
Superintendent of waterways;
Superintendent of printing;
Superintendent of purchases and supplies;
Superintendent of parks.

In the Department of Registration and Education.

Assistant director of registration and education.

Superintendent of registration;

The normal school board, which shall consist of nine officers, together with the director of the department and the Superintendent of Public Instruction. The above named officers, and each of them, shall, except as otherwise provided in this Act, be under the direction, supervision and control of the director of their respective departments, and shall perform such duties as such director shall prescribe. [Amended by Act approved June 24, 1921.]

Sec. 6. Advisory and non-executive boards, in the respective departments, are created as follows:

In the Department of Registration and Education.

Neither the Director, Assistant Director, Superintendent of Registration, nor any other executive and administrative officer in the Department of Registration and Education shall be affiliated with any college or school of medicine, pharmacy, dentistry, nursing, optometry, embalming, barbering, veterinary medicine and surgery, architecture, or structural engineering, either as teacher, officer or stockholder, nor shall he hold a license or certificate to exercise or practice any of the professions, trades or occupations regulated.

The Department of Registration and Education:

The director of registration and education shall receive five thousand dollars;

The assistant director of registration and education shall receive three thousand six hundred dollars;

The superintendent of registration shall receive four thousand two hundred dollars.

10. No member of an advisory and non-executive board shall receive any compensation.

11. Each executive and administrative officer, except the two food standard officers, the members of the mining board, and the members of the normal school board shall devote his entire time to the duties of his office and shall hold no other office or position of profit.

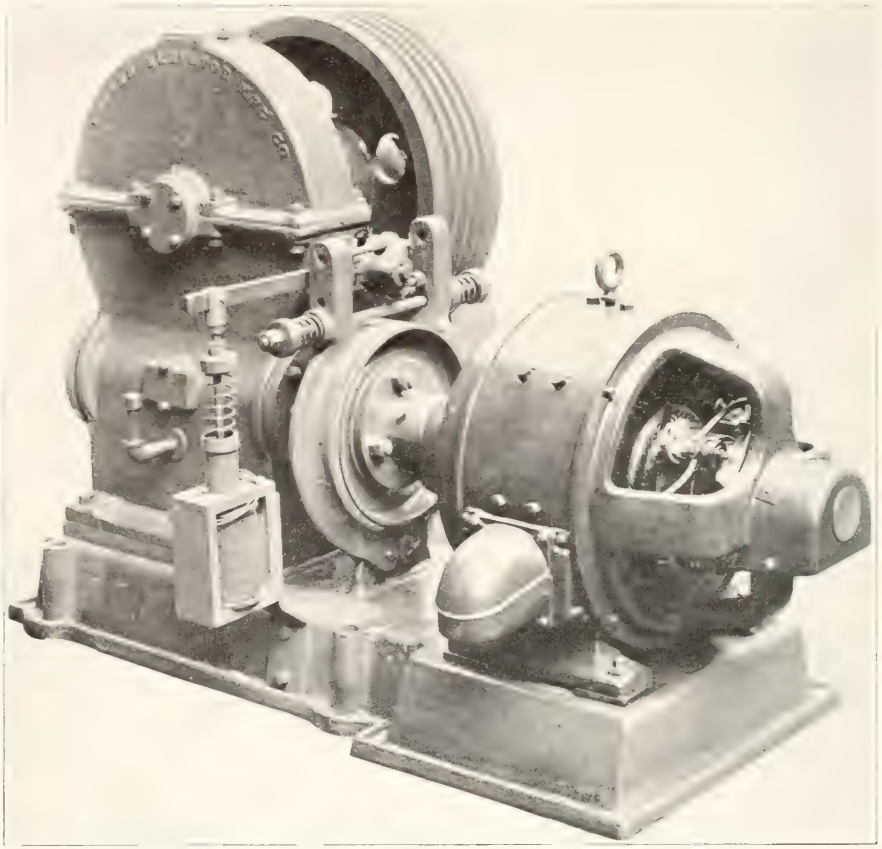
12. Each officer whose office is created by this Act shall be appointed by the Governor, by and with the advice and consent of the Senate. In any case of vacancy in such offices during the recess of the Senate, the Governor shall make a temporary appointment until the next meeting of the Senate, when he shall nominate some person to fill such office; and any person so nominated, who is confirmed by the Senate, shall hold his office during the remainder of the term until his successor shall be appointed and qualified. If the Senate is not in session at the time this Act takes effect, the Governor shall make a temporary appointment as in case of a vacancy.

14. Each officer whose office is created by this Act shall, before entering upon the duties of his office, take and subscribe the constitutional oath of office, which shall be filed in the office of the Secretary of State.

15. Each executive and administrative officer whose office is created by this Act shall, before entering upon the discharge of the duties of his office, give bond, with security to be approved by the Governor, in such penal sum as shall be fixed by the Governor, not less in any case than ten thousand dollars, conditioned for the faithful performance of his duties, which bond shall be filed in the office of the Secretary of State.

16. The director of each department is empowered to prescribe regulations, not inconsistent with law, for the government of his department, the conduct of its employees and clerks, the distribution and performance of its business and the custody, use and preservation of the records, papers, books, documents, and property pertaining thereto.

17. Each department shall maintain a central office in the capitol building at Spring-



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field, in rooms provided by the Secretary of State. The director of each department may, in his discretion and with the approval of the Governor, establish and maintain, at places other than the seat of government, branch offices for the conduct of any one or more functions of his department.

18. Each department shall be open for the transaction of public business at least from eight-thirty o'clock in the morning until five o'clock in the evening of each day except Sundays and days declared by the negotiable instrument Act to be holidays.

19. Each department shall adopt and keep an official seal.

20. Each department is empowered to employ, subject to civil service laws in force at the time the employment is made, necessary employees, and, if the rate of compensation is not otherwise fixed by law, to fix their compensation.

Sec. 25. Each director of a department shall annually on or before the first day of December, and at such other times as the Governor may require, report in writing to the Governor concerning the condition, management and financial transactions of his respective department. In addition to such reports, each director of a department shall make the semi-annual and biennial reports provided by the Constitution. The departments shall make annnual and biennial reports at the time prescribed in this section, and at no other time.

26. The directors of departments shall devise a practical and working basis for cooperation and coordination of work, eliminating duplication and overlapping of functions. They shall, so far as practicable, cooperate with each other in the employment of services and the use of quarters and equipment. The director of any department may empower or require an employee of another department, subject to the consent of the superior officer of the employee, to perform any duty which he might require of his own subordinates.

27. The gross amount of money received by every department, from whatever source, belonging to or for the use of the State, shall be paid into the State treasury, without delay, not later in any event than ten days after the receipt of the same, without any deduction on account of salaries, fees, costs, charges, expenses or claim of any description whatever. No money belonging to, or for the use of, the State shall be expended or applied by any department except in consequence of an appropriation made by law and upon the warrant of the Auditor of Public Accounts.

35. The following offices, boards, commissions, arms, and agencies of the State government heretofore created by law, are hereby abolished, viz.:

State board of examiners of architects, State board of examiners of structural engineers, secretary of the State board of examiners of structural engineers, secretary-treasurer of the State board of examiners of architects, State inspector of masonry, public buildings and works, assistant State inspectors of masonry, public buildings and works, the board of administration.

The Department of Public Works and Buildings.

49. The department of public works and buildings shall have power:

1. To exercise the rights, powers and duties vested by law in the State highway department, the State highway commission, the chief State highway engineer, the assistant State highway engineer, and other officers and employees of the State highway service;

2. To exercise the rights, powers and duties vested by law in "The Canal Commissioners," their officers and employees;

3. To exercise the rights, powers and duties vested by law in the rivers and lakes commission of Illinois, its officers and employees;

4. To exercise the rights, powers and duties vested by law in the Illinois waterway commission, its secretary, chief engineers, its other officers and employees;

5. To exercise the rights, powers and duties vested by law in the Illinois park commission, its officers and employees;

6. To exercise the rights, powers and duties vested by law in the Fort Massac trustees, their officers and employees;

7. To exercise the rights, powers and duties vested by law in the Lincoln homestead trustees, their officers and employees;

8. To exercise the rights, powers and duties vested by law in the board of commissioners of and for the Lincoln monument grounds, its officers and employees;

9. To exercise the rights, powers and duties vested by law in the superintendent of printing, his officers and employees;

10. To make contracts for and superintend the telegraph and telephone service for the several departments;

11. To purchase and supply all fuel, light, water and other like office and building services for the several departments except where the same are now supplied by the Secretary of State.

12. To procure and supply all furniture, general office equipment and general office supplies (other than stationery and office supplies distributed through the office of the Secretary of State) needed by the several departments;

13. To procure and supply all clothing, instruments and apparatus, subsistence and provisions for the charitable, penal and reformatory institutions;

14. To procure and supply all cots, beds, bedding, general room and cell equipment, table, kitchen and laundry equipment, agricultural implements, harness, stable and garage supplies, household supplies, periodicals, machinery and tools, medicines and medical supplies, plumbing, light and engine supplies, wagons and other vehicles and workshop supplies needed by the several departments;

14a. To purchase and supply all necessary tools, machinery, supplies and materials to be used by the State in or about constructing or maintaining State highways;

15. To prepare, or cause to be prepared, general plans, preliminary sketches and estimates for the public buildings to be erected for any department;

16. To have general supervision over the erection and construction of public buildings erected for any department, and over the inspection of all materials previous to their incorporation into such buildings or work;

17. To make contracts for, and supervise the construction and repair of buildings under the control of any department;

18. To prepare and suggest comprehensive plans for the development of grounds and buildings under the control of any department;

19. To make and provide all drawings, plans, specifications and models for the construction and perfection of all systems of sewerage, drainage and plumbing for the State in connection with the buildings and grounds under the control of any department;

20. To erect, supervise and maintain all public monuments and memorials erected by the State except where the supervision and maintenance thereof is otherwise provided by law;

21. To lease, for a term not exceeding two years, storage accommodations for the several departments;

22. To lease, for a term not exceeding two years, unproductive and unused lands or other property under the control of any department, unless longer leases thereof are expressly authorized by some law enforced by the department;

23. To lease, for a term not exceeding two years, office space in buildings for the use of the several departments;

24. To have general supervision and care

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of storerooms and offices leased for the use of the departments.

50. The advisory and non-executive boards in the department of public works shall discharge the following advisory powers and functions:

The board of art advisors shall advise to the artistic character of State buildings, works and monuments, now or hereafter constructed, and to any work of a permanent character intended for decoration or commemoration;

The board of water resource advisors shall advise relative to riparian rights of the State, and the conservation, use and development of water resources;

The board of highway advisors shall advise relative to the construction, improvement and maintenance of State highways;

The board of park and buildings advisors shall advise relative to the construction, improvement and maintenance of State parks, buildings and monuments.

51. The director of public works is authorized, with the consent in writing of the Governor, to acquire, by private purchase or by condemnation under the eminent domain Act, the necessary lands for the public buildings and grounds for the departments.

52. All moneys received by the director of public works from rents, leases, sale of property or from any other source in connection with the management of the Illinois and Michigan Canal shall be covered into the State treasury, and shall be placed by the State Treasurer to the credit of a special fund to be known as the "Illinois and Michigan Canal fund."

The Department of Registration and Education.

58. The department of registration and education shall have power:

1. To exercise the rights, powers and duties vested by law in the board of education of the State of Illinois, the board of trustees of the Southern Normal University at Carbondale, the board of trustees of the Northern Illinois State Normal School at DeKalb, the board of trustees of the Eastern Illinois State Normal School at Charleston, and the board of trustees of the Western Illinois State Normal School at Macomb;

2. To exercise the rights, powers and duties vested by law in the board of veterinary examiners and the State board of live stock commissioners relating to the practice of veterinary medicine and surgery in the State of Illinois;

3. To exercise the rights, powers and duties vested by law in the board of examiners of horseshoers;

4. To exercise the rights, powers and duties vested by law in the State board of examiners of architects;

5. To exercise the rights, powers and duties vested by law in the State board of examiners of structural engineers.

60. The department of registration and education shall, wherever the several laws regulating professions, trades and occupations which are devolved upon the department for administration so require, exercise, in its name, but subject to the provisions of this Act, the following powers:

1. Conduct examinations to ascertain the qualifications and fitness of applicants to exercise the profession, trade or occupation for which an examination is held; and pass upon the qualifications of applicants for resiprocal licenses, certificates and authorities;

2. Prescribe rules and regulations for a fair and wholly impartial method of examination of candidates to exercise the respective professions, trades or occupations;

3. Prescribe rules and regulations defining, for the respective professions, trades and occupations, what shall constitute a school, college or university, or department of a university, or other institutions, reputable and in good standing and to determine the reputability and good standing of a school, college or university, or department of a university, or other institution, reputable and in good standing by reference to a compliance with such rules and regulations;

4. Adopt rules providing for and establishing a uniform and reasonable standard of maintenance, instruction and training to be observed by all schools for nurses which are to be deemed reputable and in good standing and to determine the reputability and good standing of such schools for nurses by reference to compliance with such rules and regulations;

5. Establish a standard of preliminary education deemed requisite to admission to a school, college, or university, and to require satisfactory proof of the enforcement of such standard by schools, colleges and universities;

6. Conduct hearings on proceedings to revoke or refuse renewal of licenses, certificates or authorities of persons exercising the respective professions, trades or occupations, and to revoke or refuse to renew such licenses, certificates or authorities;

7. Formulate rules and regulations when required in any act to be administered.

None of the above enumerated functions and duties shall be exercised by the department of registration and education, except upon the action and report in writing of persons designated from time to time by the director of registration and education to take such action and to make such report, for the respcetive professions, trades and occupations as follows:

For the architects, five persons, one of whom shall be a member of the faculty of the University of Illinois, and the other four of whom shall be architects residing in this State, who have been engaged in the practice of architecture at least ten years;

For the structural engineers, five persons, one of whom shall be a professor in the civil engineering department of the University of Illinois, and the others of whom shall be structural engineers of recognized standing, who have had not less than ten years' practical experience, then practicing as structural engineers in this State.

The action or report in writing of a majority of the persons designated for any given trade, occupation or profession, shall be sufficient authority upon which the director of registration and education may act.

In making the designations of persons to act for the several professions, trades and occupations, the director shall give due consideration to recommendations by members of the respective professions, trades and occupations and by organizations therein.

Whenever the director is satisfied that substantial justice has not been done either in an examination or in the revocation of or refusal to renew a license, certificate or authority, he may order reexaminations or rehearings by the same or other examiners.

61. All certificates, licenses and authorities shall be issued by the department of registration and education, in the name of such department, with the seal thereof attached.

Repeal.

64. The following Acts and parts of Acts are hereby repealed:

"An Act creating the office of supervising architect of the State of Illinois and defining his powers and duties," approved April 24, 1899, in force July 1, 1899;

"An Act creating the office of supervising engineer for the General Assembly, its members and committees, and the Board of Administration of the State of Illinois, and fixing his compensation," approved June 10, 1911, in force July 1, 1911;

"An Act to create a State art commission, and to define its powers and duties," approved June 4, 1909, in force July 1, 1909;

An Act creating the office of State inspector of masonry, public buildings and works, and prescribing qualifications, duties and compensation," approved June 28, 1915, in force July 1, 1915.

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OFFICE PRACTICE

By Illinois Society of Architects.

Believing that uniform practice in various architects' offices is desirable for all concerned, this Society recommends that the following conditions prevail in architects' offices of the State of Illinois:

Classification of Employes.

First. That employes be classed as Regular and Special;

Second. Employes classified as "Regular" will be those continually engaged for a period of not less than one year, on a weekly salary basis; it is expected that such employes will assume greater responsibilities to their employers and be granted special privileges, in consideration of faithful service;

Third. Employes classified as "Special" will be those engaged temporarily. It is deemed proper that such employes be paid by the hour for actual service rendered, making no allowance for vacations or holidays, it being considered fair under these circumstances to allow these draughtsmen a slightly higher rate per hour than regular employes who enjoy privileges of vacations and holidays.

Office Hours.

First. It is understood that draughtsmen are expected to be in their respective offices ready to begin actual work at the hours stated, and that they will continue in service at least until the hours fixed for cessation of work;

Second. The regular opening time of offices shall be 8:30 A. M., throughout the year;

Third. Period of service for Monday, Tuesday, Wednesday, Thursday and Friday, in the morning, shall be four hours, extending to 12:30 P M., that the lunch hour shall be one hour, extending from 12:30 to 1:30 P. M.; that the afternoon period shall be four hours, extending from 1:30 to 5:30 P. M.;

Fourth. That the Saturday period of service shall consist of 4½ hours, extending from 8:30 A. M. continously to 1:00 P. M.

Units of Service.

First. One week's service will consist of 44½ hours;

Second. One year's service will consist of 2,180½ hours.

Pay-Day.

First. That pay-day shall be on Monday of every week;

Second. That each pay-day draughtsmen be paid up to the Saturday night preceding.

Holidays and Vacations.

First. We recommend that "Regular" draughtsmen be given the following holidays on full pay: New Year's, Decoration Day. July Fourth, Labor Day, Thanksgiving, Christmas;

Second. That all "Regular" draughtsmen having been in the employ of an architect for more than one year be given two weeks' vacation on full pay, at time most convenient for employer;

Third. It should be understood that "Regular" draughtsmen, quitting the employer's service of their own volition, preceding the completion of any year's service, shall not be entitled to vacation allowance;

Fourth. "Regular" employes terminating service at the request of their employer shall be entitled to an allowance in cash proportionate to two weeks' salary allowed for vacation in the same ratio as period of service bears to one year;

Fifth. Vacations and holidays are understood to be granted to employes for rest and recuperation, the employe being understood to be in the service of the employer during vacation and holiday time just to the same extent as when regularly engaged in the office;

Sixth. It is recognized that an average of 44½ hours per week's service is the maximum efficient service that can be continuously rendered without detriment to the health or efficiency of the employe, and that where the employe engages in outside architectural service of any sort for others, he does so at the expense of his employer, and his employer should be credited for corresponding loss of time. The practice of employes of one employer working nights or holidays for another is condemned as detrimental to the best interests of both employer and employe;

Seventh. In case of emergencies of short duration, "Regular" employes are expected to work over-time for the employer without extra remuneration other than a reasonable allowance for the expense of taking meals away from regular lodging place. In such cases, however, the employes will be credited with off time on account of sickness or otherwise, equivalent to the amount of overtime service rendered in cases of emergency;

Eighth. Draughtsmen are encouraged, however, to make use of a portion of their time off for educational improvement.

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SUGGESTIONS FOR FIRMS ISSUING CATALOGUES AND PRINTED MATTER

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Exact and specific technical detail appeals to an architect because it enables him to judge quickly and correctly.

Drawings to scale of parts or the whole make arrangement or mechanism most quickly clear to the technically educated.

Testimonials from those technically incompetent to judge carry no weight with the competent.

Architects want authentic technical information about all building materials and devices.

Architects do not want to wade through a sea of laudatory verbiage in order to discover an islet of real usable information.

Architects must cover an immense variety and amount of detail in selecting the numerous materials that enter into a building.

Where much detail is handled by a single individual, success is dependent on system.

Information to be immediately available for architects must be classified so that each detail can be considered separately and in order.

Advertisers recognizing these principles and presenting exact technical information under proper classification, free from irrelevant matter and in convenient form for filing, so as to be available when that item is up for consideration, are most likely to secure satisfactory results from their efforts.

It is believed that most architects have their own particular system of filing and classification and would not take kindly to any advertising scheme contemplating the placing of filing cabinets in architects' offices and distribution by those interested in the promotion of advertising scheme. Architects do not take kindly to allowing outsiders access to their private catalogue filing cabinets, and it is impractical to have two filing systems in the same office.

Practical requirements in the preparation of specifications make it necessary for architects to divide their specifications into topics very similar to trade divisions brought about by divisions of labor promulgated by labor authorities, and no single division or chapter of a catalogue should contain matter pertaining to more than one trade; unless the material referred to is used by several trades. It is hoped that eventually the architects may agree on a satisfactory universal building material classification or index. But it is certain that this time has not yet arrived and that no person not actually having had extended experience in the preparation of architects' specifications is capable of preparing such an index that would be practical.

STANDARD SIZES
Requested by Architects

Believing that uniform practice by the various publishers of catalogues and literature for distribution to architects is desirable for all concerned, and wishing to be in accord with the recommendations of the American Institute of Architects, the Illinois Society of Architects advise that all literature for this purpose be prepared to comply as nearly as possible with the conditions set forth, as follows:

First: That 8½"x11" shall be the standard sized page for all general catalogues and bulletins intended for permanent filing by architects; thus making a size convenient for filing in the standard letter-size vertical filing cabinets, such as may be procured from any concern dealing in office filing devices.

Second: That 3¾"x8½" shall be the standard size for post cards and pocket editions intended for the use of architects; thus making a size convenient for filing three to the page, side by side, in standard letter-size vertical filing cabinets; or one to the page, on side, in standard vertical check files; or on end in standard legal document files; also convenient for mailing in standard legal size envelopes.

Third: That all catalogues should be issued in the form of separate bulletins, or chapters separated by a blank page, each treating of but one subject, on both sides of the same sheet, so as to make separation easy for classification purposes.

Fourth: That it is important to have pages cut to exact size; if over size in any particular they may not go into files; if under size, they may be overlooked in running through the files hastily.

Fifth: That these recommendations go into effect January 1, 1915, and that following that date, architects be advised to decline to receive literature for filing which does not comply with standard sizes.

Illinois Society of Architects

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Explaining the Function, Scope, Service and Method of Operation of the National Council of Architectural Registration Boards

Introductory Statement.

1. Briefly stated, the Council constitutes a clearing house for the convenience of the registration authorities of the various states having laws regulating the practice of architecture. Its active membership is composed of such states. Its membership is not elected, but is constituted of those States whose registration authorities subscribe to its Constitution and By-Laws and pay the annual membership fee. No State which has a law regulating the practice of architecture can be denied membership in the Council, provided its legally constituted officials sign an application blank, pay the required membership fee, and deposit five copies of its Architectural Act and of the Rules and Regulations promulgated by its examining committee or board for the purpose of regulating examinations.

2. The franchise of the Council is inherent in its active members. In other words, the control of the Council is absolutely in the hands of the architectural registration authorities of the various States which are members of the Council, each State being entitled to only one vote, even though represented by several of its officials. The officers of the Council are elected by the active members to carry out their will.

I. Reciprocal Transfer of Registration.

It is expected that architects desiring reciprocal transfer of registration credit from one State to another will find it convenient and practical to effect this transfer through the medium of the National Council of Architectural Registration Boards. In most cases where this method is followed, the applicant will be saved the necessity of a personal appearance and examination before any examining committee other than that of his home State. While the Council does not guarantee the acceptance of all applicants who apply for transfer of registration through the Council, it is in a position to and does furnish State examining committees with the results of an unprejudiced and disinterested investigation of the applicant's qualifications, moral, educational, and legal. With this data in hand the examining authorities in the State to which the applicant desires transfer are furnished evidence which is usually considered sufficient upon which to predicate judgment as to the applicant's eligibility for registration in accordance with the laws of that State.

II. Explanation and How to Avoid Delays.

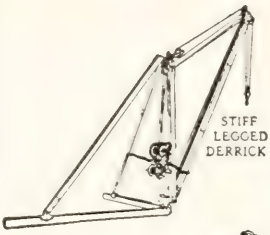
The Council fully realizes that often time is a very important consideration with the applicant for architectural registration or for reciprocal transfer of architectural registration, and it wishes to call architect's careful attention to some of the causes of delay and how delays may be avoided. To begin with, the applicant should appreciate the following facts:

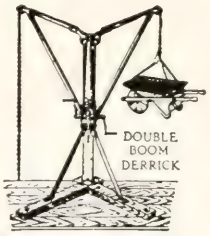
1. Since Architectural Examining Boards, Commissions or Committees for the various states are made up of men in private practice who serve without remuneration or at the most with a small per diem remuneration plus an allowance for actual expenses, they cannot and do not meet more often than once or twice a year; hence, if an application reaches the Secretary of such a Committee just after a meeting, there may be a long delay before the application can be taken up for consideration.

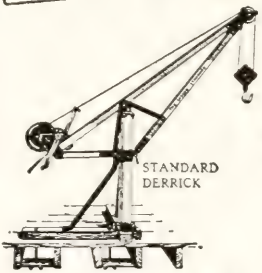
2. No Examining Commission can give intelligent consideration to an application for the transfer of registration or to the registration of an architect engaged in practice in another state where there is no law regulating the practice of architecture without a careful independent investigation of the applicant's credentials and his record in practice for reasons hereinafter set forth.

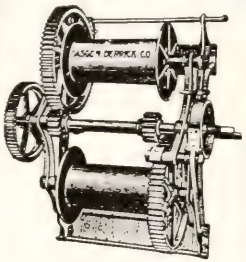
Fraud is sometimes practiced by the unscrupulous, in consequence therof there is need of investigation in order to give protection to the public, also in justice to the honest majority of applicants, but the investigations conducted must be entirely independent of the applicant. In other words, diplomas, certificates, testimonial letters, etc., when submitted by the applicant may be, and are in rare cases, fraudulent. There have been cases where certificates of registration in other states have been fraudulently altered, the same is true with reference to school certificates, society memberships, and testimonial letters presented by applicants from architects and clients. There have been cases where certificates of registration of men long since dead have been used as a basis for reciprocal transfer by those fraudulently posing as the original registrants. For this reason, identification photographs are now being insisted upon by registration authorities in most of the states.

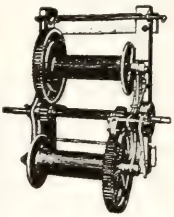
3. Independent investigations must be conducted largely by correspondence, often over long distances, in a considerable number of cases to foreign countries, thus necessarily consuming considerable time. The Council's experience in conducting these independent investigations, indicates that the average time is approximately six weeks, the minimum time is never less than four weeks, and the maximum time, three to six months, particularly in the case of foreign correspondence and where inaccurate ad-

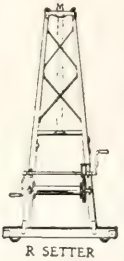


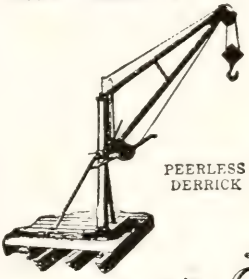


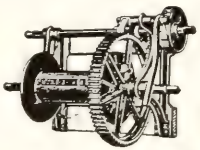


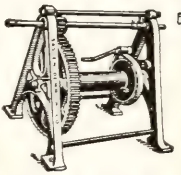


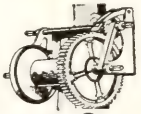


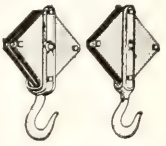


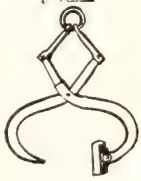


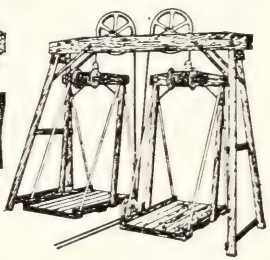












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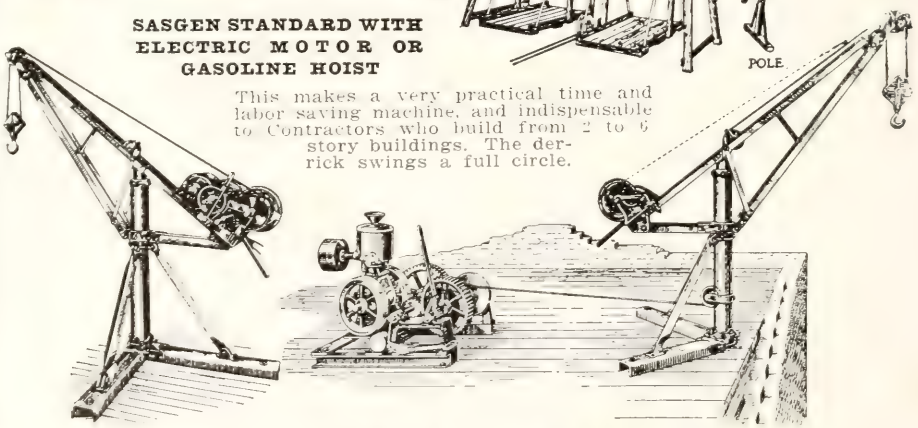

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dresses are given and in the case of absent correspondents delaying replies to inquiries.

4. The evil consequences incident to the long time required for investigations can be eliminated if architects will file applications with the Council for investigations of their record before they desire transfer to any state, have the investigation completed and placed on file with the Council, then if they suddenly wish transfer to a certain state the Council is in a position to immediately send a certified copy of an independent investigation of their record to the Examining authorities of the state where they desire transfer. This record will be in such shape that it may be passed from member to member of the local Examining Committee by means of registered mail, so that their decision may be secured by letter-ballot, thus avoiding the great loss of time incident to waiting for a stated meeting of an Examining Board. In this way, transfer has often been effected in time not to exceed two or three weeks. Wise men engaged in interstate business are taking this precaution and finding it advantageous. It should be universal practice.

III. Investigations by the Council.

In investigating the applicant's record, the Council writes:

First, to the registrars or principals of the schools where he has received his training, asking for a certified copy of his school record while in attendance upon these various institutions.

Second, it writes to the examining authorities of his home State for a certificate as to his registration in that State and inquiring as to whether charges have ever been preferred against him involving recklessness or carelessness in the design or supervision of buildings or dishonest practice.

Third, inquiry is made of his former employers, if he comes under the junior classification, concerning his record and promise as an architectural employee.

Fourth, inquiry is also made from at least three of his clients as to his competency and faithfulness in the execution of trusts imposed in him.

Fifth, inquiry is made of at least three architects as to their knowledge of the character and competency of his practice.

Sixth, inquiry is also made of professional and technical societies as to his membership and his record for honorable practice.

When replies to these inquiries are received, they are carefully copied and certified to by the Executive Secretary of the Council and forwarded to the examining authorities where the architect desires registration.

The Council endorses no one and expresses no opinion whatsoever. It simply collects the information and forwards it for the judgment of the local examining committee.

IV. In Applying for Council Service.

To employ the services of the Council, for the purpose of obtaining reciprocal transfer of registration credit from one state to another, request should be made of the Secretary of the National Council of Architectural Registration Boards, at 5 N. La Salle Street, Chicago, Illinois, for the furnishing of necessary blanks and instructions as to further procedure.

With this request should be embodied statements and enclosures in conformity with the following:

1. A par value, at Chicago, check or draft for Twenty Dollars ($20.00) made payable to the "N. C. A. R. Boards," the required advance payment of the Council's prescribed fee to defray the expenses incident to an investigation of the applicant's record.

See Art. VIII.

2. A statement giving the state or states where the applicant is at present registered and in each case, the manner in which such registration was obtained, whether by "Exemption," "Reciprocal Exchange," "Written" or "Oral Examination"; the duration and subjects covered by each of the successful registration examinations enumerated, and the dates and official numbers of each registration.

3. A statement as to the number of years that the applicant has been engaged in the professional practice of architecture as a principal. It should be noted that employment in an architect's office as a foreman, draftsman, specification writer or superintendent is not acting as a principal or one of the principals in charge of an architect's office, neither is business as a building contractor or such contractor's superintendent, draftsman or estimator considered the practice of architecture as a principal.

A person may be considered a principal in the practice of architecture as a profession if he only serves a single client, on a salary or other basis, in an office maintained by such client, if it can be established that he was entirely responsible for and in complete control of the architectural work and administration of that office during the entire time enumerated "architectural practice as a principal," i. e., did he sign the work as architect and exercise control over those engaged on the design and supervision of the work executed, including the power of employment and discharge?

V. General Instructions.

1. Upon the receipt of the before-mentioned statements and payment of fee, the Secretary of the National Council will forward to the applicant an Application Blank and an Information Blank which should in due course be filled out by the applicant, certified to by a Notary Public and returned to the Council as a basis for its investigation. Too much emphasis cannot be laid on the importance of using great care in filling out the Information Blank and making the statements as completely comprehensive as space will permit.

2. Since the Information Blank must be reproduced in facsimile, it is very important that the ink used in filling in answers to the

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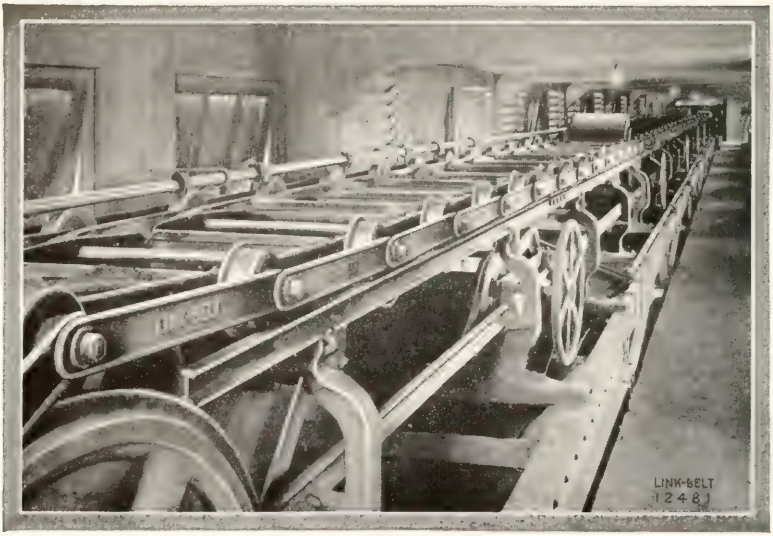

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various questions shall be black opaque, susceptible to photographic or blue-print reproduction. Common drafting ink is the most practical. The typewriter may be used if the paper is backed with a fresh black carbon, so as to form a good blue-print negative. Actual dates of attendance at schools are important. Addresses of school principals, registrars, secretaries of societies, clients, and architectural references should be accurately given.

3. Much delay has resulted from failure to give this information correctly. Inaccurate or incomplete information only delays the completion of the record, as no record will be forwarded to the examining authorities of the State where the architect wishes transfer until the required number of references have been heard from.

4. Either at the time of sending the Application and Information Blanks to the applicant or at some time during the investigation of his references he will be informed by the National Council as to the amount of his preliminary fee which he must pay to the State examining authorities where he desires registration and, upon receipt of this information, he will forward to the Council a certified par value check covering the amount of that fee made out to the proper registration authorities of the State where he desires registration, as per instructions of the Council. This check will be held by the Council until applicant's record is finally completed, and will be forwarded to the State where he wishes registration along with the information collected concerning his record.

5. A film negative identification photograph of the applicant, with two (2) unmounted prints, each signed and certified to, shall be furnished the Council by the applicant at some time before its investigations are completed. Glass negatives are not acceptable.

VI. Additional Transfers.

Copies of the original credentials are preserved in the Council office and become a part of the applicant's permanent record. Should he desire to transfer to additional States, he may have this transfer facilitated through the offices of the Council by applying for a transfer in the same manner as in the case of the original application, except enclosing a fee made payable to the Council of Five Dollars ($5.00). In such cases, the Council will simply send a duplicate copy of his record to the additional State where applicant desires registration, except in cases where a long time has elapsed between the original investigation and the time of application for an additional transfer. The Council will make further investigation to ascertain if the applicant has continued to maintain the high standard indicated by the original investigation. Additional information thus obtained is embodied in the original record and procedure otherwise as in the first case.

VII. Remittances to State Boards.

The best method of making remittances to State Examining authorities is by means of the certified personal check of the applicant, adding the small exchange where this is required to the amount of the check; noting on the lower left-hand corner of the check the purpose for which this check is issued. This is a very much more satisfactory method of remittance than by use of bank draft, money order or postal order, as if certified, it is equally as safe to the state authorities receiving same as the bank draft.

It is no more expensive than the bank draft or postal money order, requires no longer time to secure same; presents concrete and exact evidence of payment, and the purpose for which payment is made. The applicant may then know by his returned check when his remittance has been cashed by the state to which it has been sent.

VIII. Concerning Fees.

The fees charged by the Council barely defray the expenses of its investigations. The Council is an institution organized "not for profit." All Council fees are in addition to State examining and registration fees. Should complaint be urged that the fees charged by the Council constitute an excessive burden on architectural practitioners who wish to engage in inter-state business, it should be pointed out that there is no requirement compelling architects to make use of the services of the Council. They are always at liberty to appear before the examining committee of the State where they wish to be registered by reciprocal transfer, submit their proofs, and receive registration or denial of registration in that State in accordance with the merits of their case. But it should be pointed out to the architects that most examining committees meet not more than twice a year and that many examining committees meet only once a year and that by mutual understanding registration by reciprocal transfer cannot except in very special cases be made between member States except on the basis of a Council investigation or by the personal appearance of the applicant before the local examining committee at one of its regular or special meetings. Transportation and hotel expense would very quickly mount up to a sum in excess of the nominal fees charged by the Council for its work; particularly when it is borne in mind that after the first investigation subsequent fees are only Five Dollars per transfer.

IX. Standard N. C. A. R. Examinations.

Because of its close relationship with the various examining authorities, the Council is in a position to facilitate uniformity of examinations. Where legal restrictions do not permit the local examining committees to give examinations equal in stringency, to those recommended by the Council as just and proper, the Council with the co-operation of the local examining committees may arrange voluntary examinations meeting the minimum requirements recommended by the Council. The laws in the different States vary materially and probably always will vary. Since these laws affect examinations the legal examination requirements in different States may be expected to continue to differ. Some States emphasize preliminary education as of paramount importance and place very little credence in examinations. Other States emphasize the importance of

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examinations as a greater consideration than the educational record. Some States are only concerned with the question of the applicant's proficiency in matters falling under the police power of the State (i. e., the conservation of life, health and property). Other States base their requirements on broad educational standards and value aesthetic skill as equal to skill in matter of safety to human life, conservation of property and protection of health. Many requirements are common to all States. Therefore, the successful passing of an examination in any State should eliminate further requirement for an examination on work passed in the State of first examination.

The Council has devised an examination standard which it has been pleased to designate as the "Standard N. C. A. R. Examination" and which is intended to cover the minimum requirements for registration in all States. The Council suggests the advisability of supplementing the regular examination of the State of applicant's residence with this additional examination. It being understood that while the examination is conducted under the supervision of the National Council and in strict accord with the rules promulgated by that body, that it is actually conducted by the State examining committee of the State of applicant's residence. Preliminary to such examinations, the applicant must apply to the Council and have his record in practice very carefully investigated, written up, and furnished to the local examining committee as part of the material which it must use in determining the applicant's right to the status. "Registered in Accord with the Standard N. C. A. R. Examination Requirements."

The Standard N. C. A. R. Examination is purely a voluntary examination. No one is compelled to take it and no one will be allowed to take it who does not seem to have had adequate preparation to justify such an examination. In the interests of fair play, large discretionary power and liberal instructions are given to the examining committee in determining the equivalent of prescribed preparation.

Junior Examinations

Junior applicants (i. e., men having had less than ten years' practice as principals), who have passed the regular State examination in their home States, are only required to pass a written examination covering the difference between their home State examination requirements and those of the National Council of Architectural Registration Boards; but they must submit evidence of attainment since entering practice and evidence of attainment before practice. Of course, if they have not been engaged in practice, they will only have to submit evidence of attainment before practice. But this fact should be emphasized—that no essential part of their records from the time that they left elementary school up until the date of their applications for examination shall be missed from the investigation. Baldly stated, they must never have been found guilty of dishonorable practice, recklessness, or carelessness in connection with the designing, erection, or supervision of buildings. Their preparation for practice must be shown to have been adequate and their practical skill in applying theoretical knowledge demonstrated, both by written examination and by practical experience.

Reproductions of the applicant's work in design are made a part of the record of the National Council and furnished to the State of transfer with each application for reciprocal transfer.

Senior Examination.

The Standard N. C. A. R. Examination for those falling under the Senior classification (i. e., men having had ten or more years' experience as principals) is based very largely on proved attainment in practice. The Council assumes that no competent man having had ten years' experience as a directing head of an architect's office should be entitled to take the status "Registered by N. C. A. R. Examination" who cannot demonstrate to the entire satisfaction of the examining jury that he has at some time during his practice actually been engaged in the competent performance of the five fundamental functions of an architect, namely: the preparation of preliminary studies, general drawings, specifications, details, and the general supervision of the work, including all incidental items of practice which go with the performance of these various functions. With this understanding, it might be possible for a man to have had an unusually complete academic and technical school preparation and yet fail in the Senior Standard N. C. A. R. Examination, if it should be proved that he was unable to apply or never had applied at some time during his architectural practice his theoretical knowledge in the performance of each of the fundamental functions of an architect.

Applicant is required to furnish with his application for the Senior N. C. A. R. Examination eighteen illustrations, of reduced size, representative of the varying character of his work. These illustrations shall be presented either in the form of photographic film negatives with two prints of each or photostatic negatives and two prints of each. The sheets are to be the architectural standard size, 8½" x 11"; each containing six illustrations, making a total of eighteen, on three sheets.

X. Application For Standard N. C. A. R. Examination and in General.

Should an applicant wish to take a Standard N. C. A. R. Examination he would proceed almost exactly in the same way as indicated in the foregoing upon making an application for reciprocal transfer, except that he shall include a fee of Twenty-five Dollars ($25.00) to the Council instead of Fifteen Dollars. The Council will proceed to investigate his record in exactly the same way as set forth for the investigation of record in the case of reciprocal transfer, with the following exception, that when the record is received and the copy made, the original replies and the original application original replies and the original information cover, certified to and forwarded to the State examining authorities in the State of the applicant's residence, together with instructions to the State Examining Committee as to the additional examinations which the applicant must take, over and above the regular State examination which he has already taken, in order to qualify under the provision, "Registered by Standard N. C. A. R. Examination." In due course, the applicant will be notified to appear before his own State Examining Committee and take the prescribed examination, which, if he passes creditably, will entitle him to the status, "Registered by Standard N. C. A. R. Examination," a status which would seem to entitle him to registration in any State without further examination and which would actually be the means of securing registration in most States having laws regulating the practice of architecture. It would mean that the applicant had the endorsement of the National Council of Architectural Registration Boards.

In both Senior and Junior cases, the applicant must furnish a small identification photograph of himself which will be printed on one of the sheets illustrative of his work. Copies of these illustrations are furnished by the Council to the authorities in the State of examination and to all transfer state authorities along with a certified copy of the other records.

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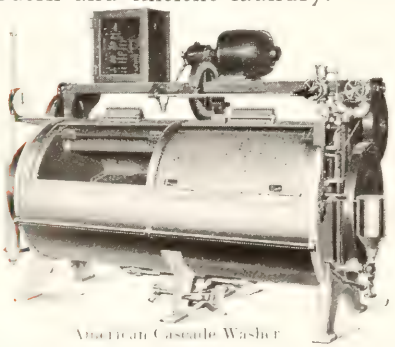

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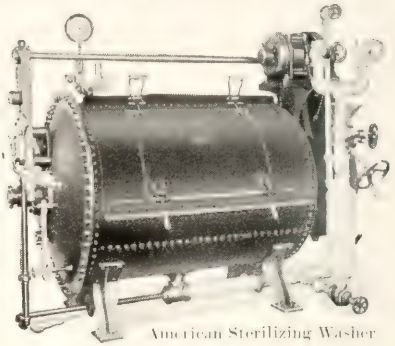

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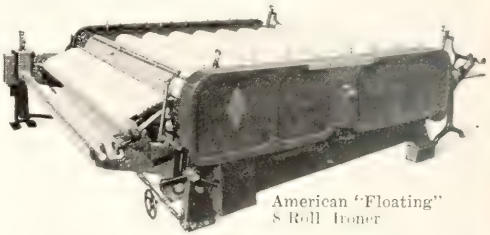

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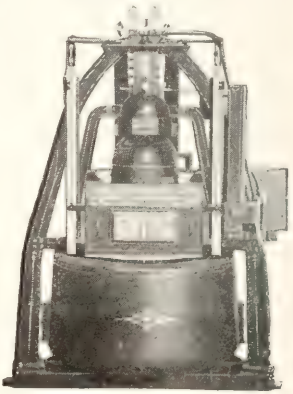
An ironing machine which will iron flat work and all kinds of wearing apparel so that 85 per cent of it will be ready to wear. By means of very delicately set springs, pressure is applied uniformly. Rolls automatically adjust themselves to the thickness of goods passing through. A complete ironing department in itself.



American "Humatic" Extractor

Inner basket revolving rapidly removes moisture by centrifugal force. Smooth running. Highly efficient. The almost human machine of the laundry industry. Safety cover. Automatic starting and stopping. Predetermined extracting time. Diameter, 40 and 48 inches.

STATES REQUIRING ARCHITECTURAL REGISTRATION

Information as to registration laws now in force in the following states may be obtained as follows

California—State Board of Architecture, Phelan Bldg., San Francisco. **Colorado**—State Board of Examiners of Architects, Denver. **District of Columbia**—Board of Examiners and Registrars, 422 Municipal Bldg., Washington. **Florida**—State Board of Architecture, 135 East Bay Street, Jacksonville. **Georgia**—State Board for Registration of Architects, Atlanta. **Idaho**—Department of Law Enforcement, Boise. **Illinois**—Department of Education and Registration, Springfield. **Louisiana**—State Board of Architectural Examiners, New Orleans. **Michigan**—State Board for Registration of Architects, Detroit. **Minnesota**—State Board of Examiners, 804 Phoenix Bldg., Minneapolis. **Montana**—Board of Architectural Examiners, Helena. **New Jersey**—State Board of Architects, 665 Broad Street, Newark. **New York**—State Board for Registration of Architects, Albany. **North Carolina**—State Board of Architectural Examination and Registration, Greensboro. **North Dakota**—State Board of Architecture, Bismarck. **Oregon**—State Board of Architectural Examiners, Portland. **Pennsylvania**—State Board of Examiners of Architects, Harrisburg. **South Carolina**—State Board of Architectural Examiners, Columbia. **Tennessee**—State Board of Architectural and Engineering Examiners, Nashville. **Utah**—State Board of Architecture, Salt Lake City. **Virginia**—State Board for the Examination and Certification of Architects, Professional Engineers and Land Surveyors, Richmond. **Washington**—State Board for Registration of Architects, Olympia. **West Virginia**—State Board of Examiners and Registration of Architects, Odd Fellows Bldg., Charleston. **Wisconsin**—Board of Examiners of Architects, Madison. Such laws are pending in Indiana, Iowa and Kansas.

REGISTRATION OF ARCHITECTS
STATE OF ILLINOIS

RULES AND REGULATIONS
General Statement

The Fifty-first General Assembly revised the law in relation to the regulation of the practice of architecture as a profession.

It is unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, wthout a certificate of registration as a registered architect duly issued by the Department of Registration and Education.

Any one, or any combination of the following practices constitutes the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

The professional features of the law are administered by a professional committee of architects, consisting of five persons, appointed from time to time by the Director of Registration and Education. The administrative provisions of the law are exercised by the Department of Registration and Education. The powers and duties of the professional committee are as follows:

1. To conduct examinations to ascertain the qualifications and fitness of applicants for registration, and pass upon the qualifications of applicants for reciprocal registration.

2. To prescribe rules and regulations for conducting examinations.

3. To decide the schools of architecture from which graduation will be accepted as the equivalent of two years of the prescribed office experience.

4. To conduct hearings on proceedings to revoke certificates of registration.

Applications

A person is qualified to receive a certificate of registration as a registered architect:

(a) Who is at least twenty-one years of age.

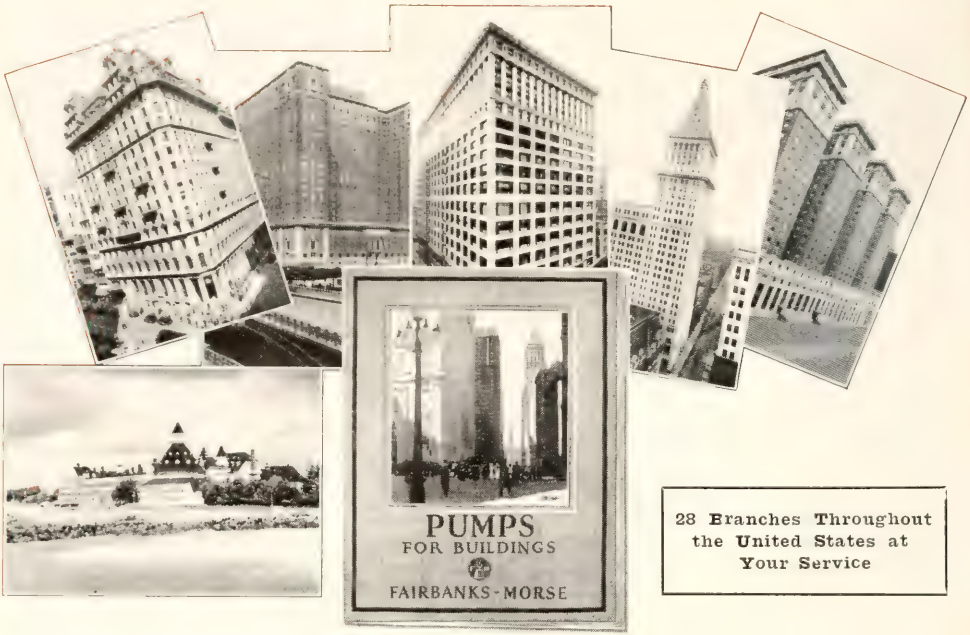
(b) Who has graduated from a high school or secondary school approved by the Department, or has completed an equivalent course of study as determined by an examination conducted by the Department, and has subsequently thereto completed such courses in mathematics, history and language as may be prescribed by the Department.

(c) Who has had at least three years' experience in the office or offices of a reputable architect or architects. A certificate of graduation from an approved school of architecture will be accepted as the equivalent of two years of the prescribed office experience; and

(d) Who has passed an examination conducted by the Department to determine his fitness to receive a certificate of registration as a registered architect.

Examinations

Examinations of applicants for certificates of registration as registered architects are held at such times and places as the Department of Registration and Education may determine, and embrace the following subjects:



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CONDENSATION

FOR
AIR WASHING
FIRE PROTECTION
HYDRAULIC ELEVATORS
REFRIGERATION
SUMP PUMPING

1. The planning, designing and construction of buildings.

2. The strength of building materials.

3. The principles of sanitation and ventilation as applied to buildings.

4. The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

The Department of Registration and Education may, by rule, prescribe additional subjects for examination.

All examinations are conducted in the English language without the use of an interpreter, and are divided into six sections, A, B, C, D, E and F.

Examination A—The Science of Planning and the Art of Designing Buildings. This examination is held the first day with a time allowance of eight hours continuous session, consisting:

First—Of a test in the science of planning, particularly with reference to practical, logical and economical arrangement; the securing of comfort and the safeguarding of life and health of the proposed occupants of the building. (Grade value 100.)

Second—Of a test in the art of designing, particularly with reference to orderly and consistent expression of purpose, logical meeting of conditions and pleasing harmonious presentation. It is not a test in a knowledge of historical styles. The grades will be based solely on the degree of perfection in meeting the before mentioned elemental requirements of good design. (Grade value 100.)

The test under "A" problem requires plans, elevations, sections and some detail drawings for a building the nature of which will be set forth in a program such as a well informed owner might be expected to give to an architect.

Time—8:30 A. M. to 4:30 P. M. en loge.

No reference books will be permitted.

Examination B—Graphic Statics and Truss Design. This examination is held the morning of the second day with a time allowance of two and one-half hours continuous session. It consists of a test in the science of graphic statics as applied to a truss problem, assuming that the preliminary designs of a building are complete, loads determined and diagram of truss settled upon. The candidate is required to determine the maximum stress in each member and its section, and to detail one or more designated joints. (Grade value 100.)

Time—8:30 A. M. to 11:00 A. M.

Free use of reference books is permitted.

Examination C—General Details. This examination is held the morning of the second day with a time allowance of one and one-half hours, consisting of a test in the knowledge of principles general detailing as shown by scale and full size details of such parts of buildings as are encountered in the usual practice of an architect. (Grade value 100.) One-half of the grade will be based on Examination C and the other half on the knowledge of detailing indicated by the other examinations.

Time—11:00 A. M. to 12:30 P. M.

No reference books or plates may be used.

Examination D—Specifications, Practice and Precedent. This examination is held the afternoon of the second day with a time allowance of three and one-half hours continuous session, consisting:

First—Of a test in the knowledge of specification writing, knowledge of the essence of the contract and of general architectural practice, as it pertains to relationship between the public, the owner, the contractor and the architect. (Grade value 80.)

Second—Of a test of general knowledge of the history of architecture and its place in social economy. (Grade value 20.)

Time—1:30 P. M. to 5:00 P. M.

No reference books may be used.

Examination E—Mechanics of Materials. This examination is held the morning of the third day, with a time allowance of four hours continuous session, consisting of a test in the sciene of determining the strength of materials and the applicant's knowledge of applied mechanics. The test requires the applicant to design the various parts of a structure and show ability to determine the safe, practical working sizes and shapes of footings, piers, columns, beams, girders and floors. Sketches will be furnished the applicant showing conditions and loading. (Grade value 100.)

Time—8:30 A. M. to 12:30 P. M.

Free use of reference books is permitted.

Examination F—Reinforced Concrete Design. This examination is held the afternoon of the third day, with a time allowance of three and one-half hours' continuous session consisting of a test in the science of computing stresses in reinforced concrete structures and involving exercises to show the applicant's knowledge of the correct design and detailing of reinforced concrete structural parts, such as footings, columns, girders, beams and floor slabs, assuming that the preliminary designs of the building are complete, loads determined, story heights and column spacing fixed. The candidate is required to compute stresses and detail parts which are safe, practical and economical for the purposes intended. (Grade value 100.)

Time—1:30 P. M. to 5.00 P. M.

Free use of reference books is permitted.

Grading of Examination Papers

Examination papers are graded as follows:

The maximum allowed on Examination A is 200; on Examinations B, C, D, E, and F, 100 each. The grade given the applicant on the whole examination is obtained by dividing the total A, B, C, D, E, and F by seven.

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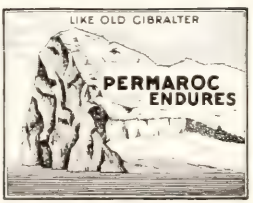

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To be successful, an applicant must make a general average of 75 with no grade in any subject below 60. If an applicant fails in his first examination, he will be permitted, upon the payment of a second examination fee, to take a second examination in those subjects in which he fell below 75 at any regular examination within eighteen months from the date of the first examination. If the applicant fails in his second examination and desires to appear for a third, it will be necessary for him to file another examination fee and be examined in ALL subjects.

Reciprocity

Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the following conditions:

(a) That the applicant is at least twenty-one years of age, of good moral character and temperate habits;

(b) That the requirements for the registration or licensing of architects in the particular state, territory, country or province were, at the date of the license, substantially equal to the requirements then in force in this State; and,

(c) That the applicant appears before the committee at one of its regular meetings with exhibits of his work.

Annual Renewal

Every registered architect who continues in active practice, shall annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year, shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon the payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five years, may have his certificate of registration renewed at any time within a period of five years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed renewal fees.

Fees

The fee to be paid by any applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect is ten ($10.00) dollars.

The fee to be paid by any applicant for a certificate of registration as a registered architect is five ($5.00) dollars.

The fee to be paid for the restoration of an expired certificate of registration is five ($5.00) dollars.

The fee to be paid upon renewal of a certificate of registration is one ($1.00) dollar.

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, is fifteen ($15.00) dollars.

Seal

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words "Registered Architect, State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision.

Instruction to Candidates

All candidates must appear at 8:00 A. M. on the days set for the examination at the place designated on their admission cards. They must bring all necessary drawing instruments, a 36-in. T-square triangle, scales, thumb tacks, etc., for examinations A, B, and C. For examinations D, E, and F, scales and triangles alone will be sufficient. The use of slide rules for mathematical calculations is permitted, but special slide rules for concrete and steel design are not to be used.

For the first day's work, applicants must bring six sheets of medium weight tracing paper 20 by 30 inches, and one sheet of heavy detail paper 24 by 36 inches. Candidates will not be allowed to leave the room on the first day, but may bring lunch.

For examinations B and C, applicants must bring three sheets of heavy tracing paper.

The paper for other examinations will be furnished by the Department.

Penalties

Each of the following acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education.

(b) The making of any wilfully false oath or affirmation in any matter or proceedings where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings, which have not been prepared by him or under his immediate personal supervision.

(d) Neglect or failure of the holder of a certificate of registration to display it in a conspicuous place in his principal office, place of business, or place of employment.

(e) Neglect or failure of a holder of a certificate of registration to stamp with his seal all working drawings and specifications prepared by him or under his supervision.

All fines and penalties shall inure to the Department of Registration and Education.

Suspensions—Revocations

The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following cases:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

All correspondence in regard to applications, examinations, etc., should be addressed to the Department of Registration and Education, Springfield, Illinois.

Published by order of

DEPARTMENT OF REGISTRATION AND EDUCATION:

ADDISON M. SHELTON,
Director.

V. C. MICHAEL,
Superintendent of Registration.

Acme Sanitary Steel Medicine Cabinets

ACME Cabinets are made of heavy gauge, rust resisting steel, properly fabricated to insure rugged durability and permanently satisfactory operation without sagging or warping. This company has specialized for years in the fabrication of highly finished steel doors and interior trim for railway passenger cars and, consequently, we have an unusual equipment of machinery, sandblasters, sprayers, and ovens for producing the highest grade enameled steel cabinets AT ATTRACTIVE PRICES.

(At Left) Acme Cabinet Without Open Shelf at Bottom, to Recess.

(At Right) Acme Cabinet with Open Shelf at Bottom, to Recess.

DIMENSIONS AND WEIGHTS

CABINET WITHOUT OPEN SHELF			CABINET WITH OPEN SHELF		
Master size			Master size		
10"x14"	12"x16"	14"x18"	10"x14"	12"x16"	14"x18"
	16"x20"			16"x20"	
Outside dimensions			Outside dimensions		
7½"x10½"	9½"x12½"		7½"x19¼"	9½"x21¼"	
10½"x13½"	12½"x15½"		10½"x13¼"	12½"x15¼"	
Inside dimensions			Inside dimensions		
7"x10"	9"x12"	11"x16"	7"x19¾"	9"x21¾"	11"x23¾"
	14"x18"		10"x13¾"	12"x15¾"	
	16"x20"			14"x18¾"	16"x20¾"
	18"x22"			16"x20¾"	
				18"x23¾"	
Wall opening required			Wall opening required		
7¾"x10¼"	9¾"x12¼"	11¾"x16¼"	7¾"x19¾"	9¾"x21¾"	11¾"x23¾"
10¾"x13¾"	12¾"x15¾"	14¾"x18¼"	10¾"x13¾"	12¾"x15¾"	14¾"x18¾"
	14¾"x18¼"	16¾"x20¼"		14¾"x18¾"	16¾"x20¾"
	16¾"x20¼"			16¾"x20¾"	
				18¾"x23¾"	
Approximate shipping weight			Approximate shipping weight		
25 lbs.	30 lbs.	40 lbs.	35 lbs.	40 lbs.	45 lbs.
	35 lbs.	45 lbs.		45 lbs.	50 lbs.

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WAGES IN BUILDING TRADES

The Citizens' Committee to Enforce the Landis Award are advised that the following are the scales which will prevail in Chicago effective July 1, 1924:

Trade	Adopted Wage
Architectural and Ornamental Iron Workers	$ 1.37½
Asbestos Workers	1.37½
Boilermakers	1.25
Bricklayers	1.50
Bricklayers, Fireproofers	1.52½
*Caisson Men (Windlass Niggerhead)	.95
*Caisson Men (Diggers)	1.10
*Carpenters	1.15
*Cement Finishers	1.10
*Cement Workers (Laborers Local No. 76)	.88¾
Composition Floor Finishers	1.37½
Composition Floor Laborers	.88¾
Comp. Roofers Teamsters, per week	34.00
Comp. Roofers Chauffeurs, per week	36.00
Electrical Workers	1.37½
Elevator Constructors	1.37½
Elevator Constructors Helpers	1.00
*Fixture Hangers	1.15
*Gas Fitters	1.15
*Glaziers	1.15
*Hoisting Engineers, Cable	1.25
*Hoisting Engineers, Others	1.00
*Laborers, Common	.82½
*Laborers, Plasterers	.93¾
Laborers, Wreckers	.70
*Lathers	1.12½
Machinery Movers and Riggers	1.27½
Marble Rubbers and Polishers	.75
Marble Setters	1.37½
Marble Setters Helpers	.87½
Mosaic and Tile Setters	1.30
Mosaic and Tile Setters Helpers	.87½
*Painters	.95 up to 1.25
Plasterers	1.50
*Plumbers	1.25
*Roofers, Composition	1.10
*Roofers, Slate	1.15
*Sheet Metal Workers	1.15
*Sheet Metal Ventilating	1.15
*Sprinkler Fitters	1.25
*Sprinkler Fitters Helpers	.85
Steamfitters	1.50
Stone Carvers	1.37½
Stone Cutters	1.37½
Stone Derrickmen	1.02½
Stone Planermen	1.05
Structural Iron Workers	1.37½
Structural Iron Rodmen	1.37½
*Terrazzo Workers	1.10
*Terrazzo Workers Assistants	.97½
*Terrazzo Workers Helpers	.85
Tuck Pointers	1.25

(Trades with this mark (*) shown are on the open-shop basis.)

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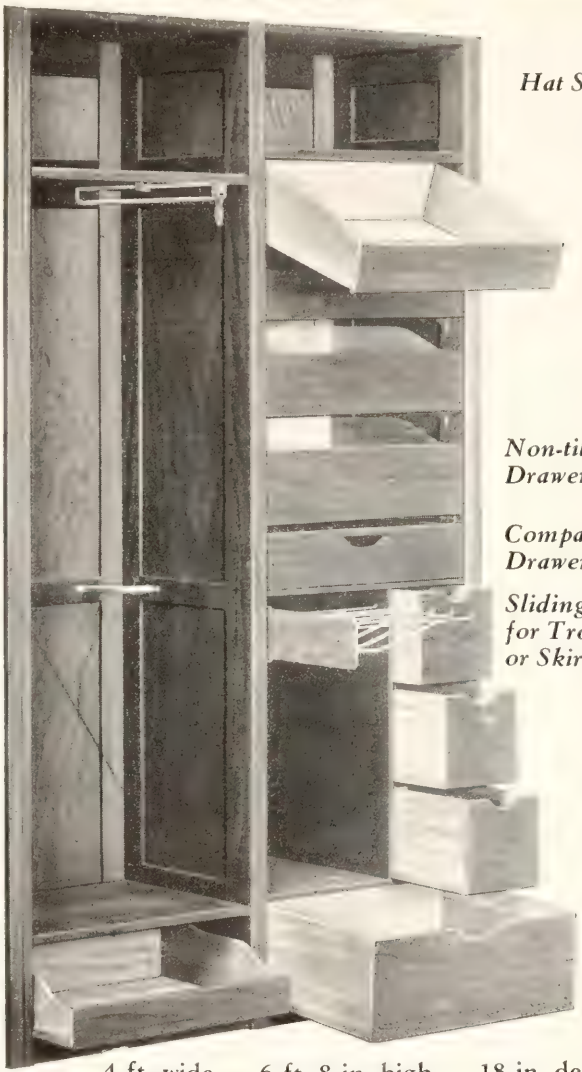

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CITY HALL AND COUNTY BUILDING INFORMATION AND GUIDE

TAXES: When and Where to Pay.

GENERAL TAXES: State, County and City.
Annually at **County Treasurer's Office,** County Building, 1st floor, north end. Must be paid before May 1 of each year. Failure to pay before May 1 means a penalty of one (1%) per cent per month until sold. (Then heavier penalty; and trouble.)

SPECIAL ASSESSMENTS: (Street Paving, Water Pipes, etc.)
Payable before July 1 at City Collector's Office, City Hall, first floor, south end.
Payable on and after August 1 at County Treasurer's Office, County Building, first floor, north end.

WATER TAX:
At Bureau of Water, City Hall, 1st floor, north end.

DOG TAX:
City Clerk, 1st floor, south end.

BUSINESS LICENSES:
City Collector's Office, 1st floor, south end.

OFFICES—CITY HALL.

Ambulance Service, Bureau of, vault floor, R. 14, south end.
Appeals, Board of (Zoning), 6th floor, R. 603, north end.
Architect, City, 10th floor, R. 1012, south end.
Billiard and Athletic Commission, 2nd floor, R. 202-A, north end.
Board of Election Commissioners, 3rd floor, R. 308, south end.
Board of Examiners:
- Motor Vehicle Operators, 180 N. LaSalle St.
- Moving Picture Operators, 6th floor, R. 614, south end.
- Plumbers, 10th floor, R. 1008, south end.
- Stationary Engineers, 10th floor, R. 1008, south end.

Board of Inspectors of Public Vehicles, 3rd floor, 180 N. LaSalle St.
Board of Local Improvements:
- General Offices, 2nd floor, R. 207, south end.
- Public Hearing Room, 1st floor, R. 104, north end.
- Law Department, 2nd floor, R. 207, south end.

Boiler Inspection, R. 601.
Buildings, Department of, 7th floor, R. 702, north end.
Bridge Division, 4th floor, R. 402, north end.
Business Agent, vault floor, north end.
City Attorney, 6th floor, R. 602, north end.
City Clerk, 1st floor, R. 107-8, south end.
City Collector, 1st floor, R. 109, south end.
City Comptroller (5th floor, north end):
- General Office, R. 501.
- Auditor, R. 504.
- Paymaster, R. 503.
- Real Estate Agent, R. 501.

City Council:
- Council Chamber, 2nd floor, R. 201, north end.
- General Committee Rooms, 2nd floor, R. 202, north end.
- Committee on Finance, 3rd floor, R. 302, north end.
- Committee on Local Transportation, 2nd floor, north end.

City Electrician, 6th floor, R. 614, south end.
City Forester, 10th floor, R. 1004, north end.
City Hall:
- Engineer, basement, south end.
- Chief Janitor, basement.

City Sealer, R. 608, south end.
City Treasurer, 2nd floor, center.
Civil Service Commission:
- General Offices, 6th floor, R. 610, south end.
- Examining Room, 10th floor, R. 1006, center.
- Trial Room, R. 612.

Compensation, Dept. of, vault floor, R. 3½ V. 15, south end.
Corporation Counsel, 5th floor, R. 511, south end.
Dog Pound, W. 29th St. and S. Sacramento Ave.
Education, Board of, 646 So. Clark St.
Engineering, Bureau of (City Engineer), 4th floor, R. 402, north end.
Election Commissioners, Board of, 3rd floor, R. 308, center.
Electricity, Department of, 6th floor, R. 614, south end.
Electrical Inspection Bureau, R. 606.
Electrical Supervisor, R. 613, south end.
Fire Department:
- Fire Marshal, 1st floor, R. 105, north end.
- Fire Alarm Telegraph, 6th floor, R. 607, center.
- Firemen's Pension Fund, Secretary of Board of Trustees (City Clerk), 1st floor, R. 107, south end.
- Department Attorney, 1st floor, R. 105, south end.

Fire Prevention & Public Safety, Bureau of, 1st floor, R. 105, south end.
Gas & Electricity, Dept. of, R. 614, center.
Gas, Oil & Electric Light, Committee on, 2nd floor, north end.
Gas Supervisor, 6th floor, R. 613, south end.
Harbor Board, R. 406, south end.
Harbor Master, Municipal Pier.
Health, Department of, 7th floor.
- Commission of Health, R. 710.
- Bureau of Food Inspection, 704.
- Bureau of Sanitary Inspection, R. 704.
- Bureau of Contagious Diseases, R. 707.
- Bureau of Vital Statistics, R. 707.
- Complaint Division, R. 704.
- Plan Examination, R. 704.
- Smoke Division, R. 704.
- Child Welfare, R. 707.
- Laboratories, R. 712.
- Social Hygiene, R. 713.

House of Correction, W. 26th St. and S. California Ave.
Laboratory, Health Department, R. 712, south end.
Law, Department of:
- Corporation Counsel, 5th floor, R. 511, south end.
- City Attorney, 6th floor, R. 602, north end.
- Prosecuting Attorney, 6th floor, R. 604, north end.
- Special Assessment Attorney, 2nd floor, south end.

Library, Chicago Public, N. Michigan Ave. and E. Washington St.
Library, Municipal Reference, 10th floor, R. 1005, north end.
License Department, R. 111.
Local Transportation, Committee on, 2nd floor, north end
Maps and Plats, Bureau of, 4th floor, R. 410, south end.
Mason Contractors, Board of Examiners of, R. 1008, south end.
Mayor's Office, 5th floor, R. 507, center.
Mayor's Safety Commission, 10th floor, R. 1001A, north end.
Morals Commission, R. 710, south end.
Motor Vehicle Operators, Board of Examiners, 180 N. La Salle St.
Moving Picture Censors, 10th floor, R. 1003½, north end.
Moving Picture Operators, Board of Examiners, 6th floor, R. 614, south end.
Municipal Court:
- Chief Justice, 9th floor, R. 917, south end.
- Bailiff, 8th floor, R. 804, north end.
- Clerk, 8th floor, R. 814, south end.
- Court Rooms, 8th, 9th and 11th floors.
- Jurors Room, R. 1009.

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Oils, Inspector of, 10th floor, R. 1013, south end.
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Assistant General Superintendent, 3rd floor, R. 306, north end.
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Custodian, floor 3½, v. 18.
Police Pension Fund, 10th floor, R. 1002, north end.
Plumbers, Board of Examiners of, 10th floor, R. 1008, south end.
Prosecuting Attorney, 6th floor, R. 604, north end.
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Public Welfare, Dept of, 139 N. Clark St.
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Bureau of Engineering, 4th floor, R. 402, north end.
Bridge Division, 4th floor, R. 402, north end.
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Bureau of Sewers, 4th floor, R. 409, south end.
Bureau of Streets, 4th floor, R. 408, south end.
Bureau of Surveys, R. 1012.
Bureau of Water, 1st floor, R. 101-2, north end.
Water Pipe Extension Division, 4th floor, R. 404, north end.
Railway Terminal Commission, 140 N. Dearborn St.
Sanitary Inspection, Bureau of, 7th floor, R. 704, north end.
Schools, Supt. of, 460 So. State St.
Sewers, Bureau of, 4th floor, R. 409, south end.
Smoke Inspection, Bureau of, R. 704, 7th floor.
Special Assessments (Board of Local Improvements), 2nd floor, R. 207, south end.
Special Assessments (Law Department), 2nd floor, R. 207, south end.
Stationary Engineers, Board of Examiners of, 10th floor, R. 1008, south end.
Statistics, Bureau of, 10th floor, R. 1005, north end.
Steam Boilers and Steam Plants, Department of Inspection of, 6th floor, R. 601, north end.
Streets, Bureau of, 4th floor, R. 408, south end.
Supervising Engineers, Board of, 231 S. La Salle St.
Supplies, Department of (Business Agent), vault floor, north end.
Telephone Supervisor, R. 613, south end.
Track Elevation, Committee on, 3rd floor, R. H.
Transportation Supervisor, R. 613, south end.
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Tuberculosis Sanitarium, Municipal, 952 N. Michigan Ave.
Vehicles, Board of Inspectors of, 180 N. La Salle St., 3rd floor.
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Water, Bureau of, 1st floor, R. 101-2, north end.
Water Pipe Extension Division, 4th floor, R. 404, north end.
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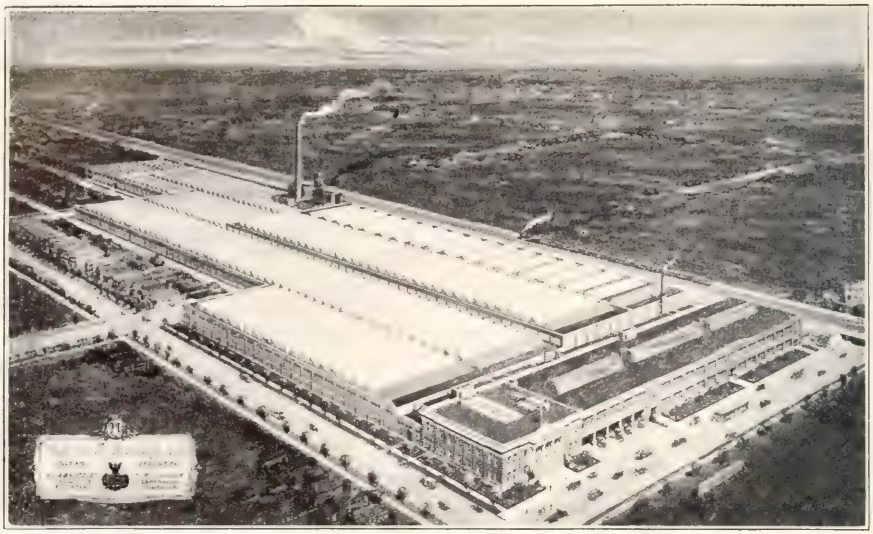

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1925-1927

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Local Industries, Streets and Alleys. Meets on Tuesdays at 10:30 A. M.—D. A. HORAN, Coughlin, Anderson, Govier, Cross, O'Toole, Moran, Ryan, Fick, Arvey, Powers, Mendel, Touhy, A. J. Horan, Adamkewicz, Smith, Seif Adamowski, Jensen, Brieske, Nelson.

Railway Terminals. Meets on Mondays at 10:30 A. M.—KAINDL, Anderson, Cronson, Eaton, Meyering, McDonough, O'Toole, McKinlay, Cepak, Toman, Arvey, Maypole, Petlak, Seif, Nusser, Albert, Nelson, Hoellen.

Gas, Oil and Electric Light. Meets on Fridays at 10:30 A. M.—CLARK, Jackson, Kunstmann, O'Toole, Moran, Ryan, Cepak, Toman, Arvey, A. J. Horan, Mills, Adamowski, Ringa, Loescher, Brieske, Hoellen, Pontow.

Buildings and Zoning. Meets on Mondays at 10:30 A. M.—O'TOOLE, Coughlin, Jackson, Wilson, Ryan, Fick, Cepak, Toman, Powers, Mendel, A. J. Horan, Smith, Petlak, Nusser, Adamowski, Jensen, Bowler, Pontow.

Judiciary. Meets on Thursdays at 2:00 P. M.—ARVEY, Coughlin, Jackson, Cronson, Eaton, Guernsey, Cross, Barbee, McKinlay, Toman, Maypole, Petlak, Seif, Mills, Brieske, Nelson, Boutell, Frankhauser.

Schools, Fire and Civil Service. Meets on Thursdays at 10:30 A. M.—BRIESKE, Cronson, Wilson, Fick, Arvey, Clark, Adamkewicz, Kaindl, Mills, Bowler, Nelson, Hoellen, Boutell, Pontow.

Harbors, Wharves and Bridges. Meets on Wednesdays at 10:30 A. M.—GUERNSEY Coughlin, Woodhull, Meyering, Govier, Cross, Wilson, Kunstmann, Barbee, Ryan, Powers, Mendel, A. J. Horan, Smith, Jensen, Bowler, Crowe.

Public Health. Meets on Fridays at 10:30 A. M.—NELSON, Anderson, Cronson, Meyering, Wilson, Barbee, McKinlay, Fick, D. A. Horan, Adamkewicz, Petlak, Seif, Nusser, Ringa, Albert, Brieske, Frankhauser.

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DECISIONS RENDERED BY THE NATIONAL BOARD FOR JURISDICTIONAL AWARDS IN THE BUILDING INDUSTRY

AIR COOLERS, AIR WASHERS AND BLOWERS, CONSISTING OF THE ASSEMBLING OF SHEET METAL AND PIPE FITTING.

(Subject of dispute between the Amalgamated Sheet Metal Workers International Alliance and the United Association of Plumbers and Steamfitters.)

Decision Rendered March 11, 1920.

The following agreement between the Amalgamated Sheet Metal Workers' International Alliance and the United Association of Plumbers and Steamfitters was confirmed:

September 9, 1918.

The undersigned committee, appointed by the general Presidents of their respective International Organizations; namely, the United Association of Plumbers, Steamfitters and Steamfitters' Helpers, and the Amalgamated Sheet Metal Workers' International Alliance, held joint conferences in the City of New York, beginning September 5, 1918, in an endeavor to arrive at an agreement concerning air washers, fans, blowers, the housing of same, and the pipe fitting on same.

After lengthy meetings participated by all of the undersigned, representing the joint Conference Committee of both International Unions, the following has been agreed to:

Section 1. That all sheet metal work of No. 10 gauge, or lighter, when used on air washers, fans, blowers or on the housing of same, shall be recognized as being the work of the members of the Amalgamated Sheet Metal Workers' International Alliance.

Section 2. That all pipe fitting in connection with the above first section shall be recognized as being the work of the steamfitters, members of the United Association of Journeymen Plumbers, Steamfitters and Steamfitters' Helpers.

Section 3. It being thoroughly understood by all of the undersigned that all of the assembling and erecting of the work as defined in Section 1, shall be the work of the members of the Sheet Metal Workers' International Alliance, excepting pipe fitting of all kinds, which shall be the work of the steamfitters and steamfitters' helpers of the United Association.

Section 4. This agreement shall become effective and in full operation for all parties concerned beginning November 1, 1918.

Signed for Sheet Metal Workers this 9th day of September 1918:

Signed for United Association.

Decision Rendered March 11, 1920.

In the matter of the controversy between the engineer and the steamfitter on the question of low pressure heat during completion of the heating system, jurisdiction shall rest with the steamfitters until the initial test is completed, immediately after which time, whenever necessary to maintain heat, a stationary engineer shall be employed either by the contractor or by the owner.

Rehearing—Decision Rendered August 2, 1923.

In the matter of the controversy between the Engineers and Steam Fitters on the question of low pressure heat during the completion of the heating system while the building is under construction, jurisdiction shall rest with the Steam Fitters until the general test has been made and the work accepted by the owner or his agent.

PIPE RAILING OR GUARDS FOR ENCLOSURES, STAIRWAYS, HATCHES, ETC.

Subject of dispute between the Bridge and Structural Iron Workers' International Association and the United Association of Plumbers and Steamfitters. Claimed by the Iron Workers entirely except when not used as a conduit for fluids or vapors; claimed by Plumbers and Steamfitters when of standard sized cut and threaded pipe.)

Decision Rendered March 11, 1920.

Pipe railing consisting of standard-sized cut and threaded pipe, not used in connection with structural or ornamental iron work, is awarded to the United Association of Plumbers and Steamfitters.

Interpretation Rendered September 15. 1920.

"Iron pipe railing consisting of a preponderance of slip-joints made rigid with or without set-screws, pinions or rivets, supported by a threaded joint and flange at base or wall, is the work of the Iron Workers. Where, however, the preponderance of joints is of standard-sized cut and threaded iron pipe, it belongs to the Plumbers and Steamfitters."

RE-ENFORCED CONCRETE, CEMENT AND FLOOR CONSTRUCTION.

(Subject of dispute between the Bridge and Structural Iron Workers' International Association and the Wood, Wire and Metal Lather's International Union.)

Decision Rendered March 11, 1920.

In the matter of controversy between the Iron Workers and Lathers over re-enforced concrete construction, it is decided that all iron and steel used for re-enforcement in re-enforced concrete, cement and floor construction be awarded to the Iron Workers.

In such cities or localities as are covered by existing agreements with employers awarding Lathers control over re-enforced concrete construction, these agreements are to be maintained inviolate until the date of their expiration, after which this decision shall prevail.

Interpretation Rendered December 4, 1920.

In the interpretation of this Board's decision of March 11, 1920, in the matter of the controversy between the Iron Workers and Lathers over re-enforced concrete construction it is not to be understood as abrogating, setting aside or in any way altering the decision of the Rochester Convention of the Building Trades Department, November 29, 1912, awarding jurisdiction over Hy-rib Lath to the Wood, Wire and Metal Lathers' International Union, and it is to be understood that the placing of Hy-rib Lath or any ribbed metal lath, however, it may be used, comes within the jurisdiction of the Wood, Wire and Metal Lathers' International Union.

VITROLITE AND SIMILAR OPAQUE GLASS.

Decision Rendered March 11, 1920.

That in the matter of the controversy between the Painters and Bricklayers on the subject herewith referred to, jurisdiction over the setting of vitrolite and similar opaque glass is awarded to the Bricklayers, Masons and Plasterers' International Union.

H. B. BARNARD

BUILDER

140 South Dearborn Street

CHICAGO

VITROLITE AND SIMILAR OPAQUE GLASS (REHEARING).

Decision Rendered May 26, 1923.

It is the opinion of the Board that the foregoing decision of March 11, 1920, is intended to convey to the Bricklayers, Masons and Plasterers International Union all counters and lavatories constructed of vitrolite or carrara glass and such glass when used in mural decorations on buildings in place of marble or other stone or used in conjunction with marble or other stone as panels on counters.

It is the further opinion of the Board that the foregoing decision is intended to convey all vitrolite, opalite, white opal and other opaque glass installed on false work, furring strips, walls, ceilings, partitions or columns, secured with screw rosettes molding, putty, expansion, toggle bolts or screws to the Brotherhood of Painters, Decorators and Paperhangers of America.

The agreement of December 5, 1910, which was concurred in by the Board of Awards on July 12, 1922, remains in effect, and any d sputes that may arise in connection with the subject of the agreement with the Board's decisions shall be adjusted in accordance with the provisions contained in Sections 3 and 4 of the agreement.

CUTTING CHASES OR CHANNELS IN BRICK, TILE, MASONRY, ETC.

Decision Rendered March 11, 1920.

That in the matter of the controversy between the Bricklayers and Electrical Workers concerning the question of cutting grooves, channels, chases, etc., the Bricklayers are awarded jurisdiction over the work, except when channels do not exceed two inches by two inches in size or require labor not to exceed eight hours continuous time, in which case the award is in favor of the Electrical Workers.

Note: This decision does not contemplate the channelling or cutting of granite or hard stone.

ASBESTOS PLASTER FOR BOILER ROOMS, ETC.

(Subject of dispute between the Operative Plasterers and Cement Finishers' International Association and the International Association of Heat and Frost Insulators and Asbestos Workers.)

Decision Rendered April 28, 1920.

In the dispute between the Asbestos Workers and Plasterers on the matter of plastering boiler rooms, etc., it is decided that the insulation and finishing coat on ceilings with asbestos and other insulating material, where the ground work has been prepared and installed by the asbestos worker, shall, including the application of insulating material on boilers, tanks, vats, etc., be awarded to the asbestos worker.

ASBESTOS SHINGLES, PREPARED PAPER ROOFING, ASPHALT ROLL ROOFING, SHINGLES AND STRIP SHINGLES.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.)

Decision Rendered April 28, 1920.

On the question in controversy between the Roofers and Carpenters on the subjects contained in the title, it is decided as follows:

Asbestos Shingles, Prepared Paper Roofing, Asphalt Roll Roofing awarded to the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.

Asphalt Shingles, Strip Shingles awarded to the United Brotherhood of Carpenters and Joiners.

BESTWALL, WHEN APPLIED AS A SUBSTITUTE FOR LATH AND PLASTER.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners, Operative Plasterers and Cement Finishers' International Association and International Union of Wood, Wire and Metal Lathers.)

Decision Rendered April 28, 1920.

In the matter of material known as Bestwall, forming a contention between the Carpenters, Plasterers and Lathers, jurisdiction shall rest with the Carpenters where material is paneled or used as sheathing; when cut, fitted and pointed, the Plasterers are recognized to have jurisdiction.

ERECTION OF SCAFFOLDS AS APPLIED TO BUILDING CONSTRUCTION.

(Subject of dispute between the International Hod Carriers, Building and Common Laborers' Union, United Brotherhood of Carpenters and Joiners, Operative Plasterers and Cement Finishers' International Association and Bricklayers, Masons and Plasterers' International Union.)

Decision Rendered April 28, 1920.

In the matter of the dispute between the Laborers, Bricklayers, Plasterers and Carpenters over the erection of scaffolds as applied to building construction, it is agreed that the erection and removal of all scaffolds including trestles ond horses used primarily by Lathers, Plasterers, Bricklayers and Masons shall be done by the Mechanics and Laborers in these trades as directed by the employer.

Self-supporting scaffolds over fourteen feet in height or any special designed scaffold or those built for special purposes shall be built by the Carpenters.

The making of horses and trestles other than temporary is the work of the Carpenter.

LIGHT IRON FURRING, BRACKETS, CLIPS, HANGERS, CORNER GUARDS, BEADS AND METALLIC LATH.

(Subject of dispute between the International Union of Wood, Wire and Metal Lathers and the International Association of Bridge and Structural Iron Workers.)

(Award of the Denver Convention, Building Trades Department, A. F. of L. adopted November, 1908. See printed proceedings, pages 69 to 71 inclusive.

Decision Rendered April 28, 1920.

In the matter of dispute between the International Union of Wood, Wire and Metal Lathers and the International Association of Bridge and Structural Iron Workers referred to in the foregoing title the following award is concurred in:

"After going into an extended hearing of the jurisdiction claims of both organizations, your committee recommends that the erection and installation of all light iron work, such as light iron furring, brackets, clips, hangers, steel corner guards or beads, and metallic lathing of all descriptions, belongs solely to the lather.

"This does not give the right, however, to the lathers to install or erect any other iron work than as herein specified and outlined.

"This decision is based in conformity with the agreement entered into by the national officers of both organizations and endorsed

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by the Kansas City Convention of Structural Iron Workers and concurred in by the American Federation of Labor."

In supplement of the foregoing decision the Rochester Convention of the Building Trades Department, November 29, 1912, awarded jurisdiction over Hy-rib lath to the Wood, Wire and Metal Lathers' International Union.

METALLIC CORNER BEADS WHEN SET IN PLASTIC MATERIAL

(Subject of dispute between the Operative Plasterers and Cement Finishers' Association and the Wood, Wire and Metal Lathers' International Union.)

Decision Rendered March 11, 1920.

In the matter of the controversy between the Plasters and Lathers on the question of the adherence of corner beads by plastic material, it is the opinion of the Board that deserved consideration was not given the subject when the previous decision was reached. It is therefore agreed that the Plasterers are awarded jurisdiction over sticking with plastic material metallic corner beads.

ACETYLENE AND ELECTRIC WELDING.

(Subject of dispute between the trades named in the following memorandum.)

Decision Rendered April 28, 1920.

In the matter of the dispute referred to in the foregoing title, as approved by the Philadelphia Convention of the Building Trades Department, A. F. of L., November, 1914 (see printed proceedings, page 99), the following agreement is concurred in:

"Representatives of the Electrical Workers, Sheet Metal Workers, Iron Workers, Plumbers and Steam Fitters, and Machinists mutually agreed to the following decision:

"Each trade to have jurisdiction over all acetylene and electric welding when such process is used to perform the work of their respective trades."

BRONZING AND PAINTING OF RADIATORS AND PIPE CONNECTIONS.

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and the United Association of Plumbers and Steam Fitters.)

(Award of Rochester Convention, Building Trades Department, A. F. of L., adopted November 29, 1912. See page 141, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in:

Resolved, That the United Association of Plumbers and Steam Fitters be and is instructed to require that its affiliated unions desist from further trespass upon the jurisdiction of the Brotherhood of Painters, Decorators and Paperhangers of America, and when and where necessary to notify their employers that neither journeymen nor helpers will be permitted to do this work.

CORK TILING, LAYING OR SETTING OF

(To Apply to Finished Floor Surfaces Only)

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Bricklayers, Masons and Plasterers' International Union.)

Decision Rendered April 28, 1920.

In the matter of the dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into this 14th day of October, 1913, by and between representatives of the United Brotherhood of Carpenters and Joiners, and representatives of Bricklayers, Masons and Plasterers' International Union.

Jurisdiction is hereby conceded the Bricklayers, Masons and Plasterers' International Union to the laying or setting of all cork tiling when laid or set in any composition of sand and Portland cement.

Jurisdiction is hereby conceded the United Brotherhood of Carpenters and Joiners to the laying or setting of all cork tiling when laid or set in any composition of glue or when nails or brads are used in laying above referred to cork tilings.

APPLICATION OF DAMP-RESISTING PREPARATIONS AND WATERPROOFING.

(Subject of dispute between United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association, and the Brotherhood of Painters, Decorators and Paperhangers.)

Decision Rendered April 28, 1920.

In the matter of dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into by and between the Brotherhood of Painters, Decorators and Paperhangers of America and the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.

First. That the painters do not claim the right to apply any of the material claimed by the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association, except such material as is applied by a brush that is ordinarily covered in their jurisdiction.

Second. That the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association does not claim the right to apply any of the material in dispute except when applied by or with a three-knot, long-handled brush, mop or swab, and spray system employed therein.

MARBLE AND SLATE PARTITIONS, BACKS AND FLOOR SLABS FOR URINAL STALLS, CLOSETS AND SHOWERS, SETTING OF.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

(Award of Rochester Convention, Building Trades Department, A. F. of L., adopted November 28, 1912. See page 132, printed proceedings. Award of Buffalo Convention, November 9, 1917. See page 92, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in:

Resolved, That the setting of floor slabs, backs, partitions of urinal stalls, closets and shower baths properly belong to the Bricklayers, Masons and Plasterers' International Union.

The foregoing decision does not concede to the Bricklayers the right to install marble work that is connected with the water supply or sewer or water-tight work regularly catalogued as plumbing fixtures.

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MUSLIN AND CANVAS FOR DECORATIVE PURPOSES, TACKING OF

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and the I. A. Heat and Frost Insulators and Asbestos Workers.)

(Award of Buffalo Convention, Building Trades Department, A. F. of L., adopted November 10, 1917. See page 108, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Resolved, That this convention notify and instruct the officers of the Asbestos Workers' International Union that the tacking of all muslin and canvas for decorative purposes is the jurisdiction of the Brotherhood of Painters and that they instruct their members to refrain from doing any of this work.

PILE DRIVING MACHINERY AND ENGINES, OPERATION OF

(Award of Buffalo Convention, Building Trades Department, A. F. of L., adopted November, 1917. See pages 59 to 105, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Such workmen as are employed in the operation of engines or machinery in connection with a pile driver come under the jurisdiction of the International Union of Steam Engineers.

SHEET METAL GLAZING FOR SASH, FRAMES, DOORS, SKYLIGHTS, ETC.

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered April 28, 1920.

In the matter of dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into by and between the General Executive Board of the Brotherhood of Painters, Decorators and Paperhangers of America, and the Amalgamated Sheet Metal Workers' International Alliance, shall take effect December 1, 1910, and remain in force until amended, revised or changed, at a meeting between three representatives of both organizations called for this purpose.

Section 1. It is agreed by both parties to this agreement that all glass set in sheet metal sash, frames, doors, or skylights, shall be set by members of the Brotherhood of Painters, Decorators and Paperhangers of America, according to their claim of jurisdiction granted by the convention of the Building Trades Department, A. F. of L., at St. Louis, December, 1910; and that all sheet metal work on sheet metal sash, frames, doors or skylights shall be done by the members of the Amalgamated Sheet Metal Workers' International Alliance.

Section 2. In localities where differences now exist or may arise in the future, such differences shall be adjusted by a committee appointed by and representing the district councils or local unions of both organizations in that locality. Should this committee be unable to agree, a representative of the General Executive Board of each organization shall be called in to assist in the adjustment.

Section 3. It is also agreed that the national officers of both organizations where local unions fail to agree shall insist that this agreement be carried out by affiliated unions.

SLATE TREADS WHEN SET ON IRON STAIR CASE.

(Subject of dispute between Bricklayers, Masons and Plasterers' International Union, and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Slate treads on iron stairs having provoked a dispute in jurisdiction between the organizations above named, was submitted to the Executive Council November 29, 1909. The action taken follows:

The Executive Council of the Building Trades Department on being called upon for a decision awarded the work in question (slate treads) to the Bricklayers, Masons and Plasterers' International Union.

UNSKILLED LABOR, WITH SPECIAL REFERENCE TO THE LOADING AND UNLOADING OF MATERIAL AS APPLIED TO REINFORCED CONCRETE CONSTRUCTION.

(Subject of dispute between the International Hod Carriers, Building and Common Laborers' Union, and International Association of Bridge and Structural Iron Workers.)

Decision Rendered August 2, 1920.

It is the decision of the Board that the loading, unloading, carrying and handling of all rods and material for use in reenforced concrete construction shall be done by the laborers under the supervision of such person as the employer may designate. The hoisting of rods, except when a derrick or outrigger is used, shall be done by laborers—this decision to apply only to the character of work stipulated herein. In such localities where existing agreements provide otherwise, this decision is to become effective at the expiration thereof.

DEFECTS IN CONCRETE CAUSED BY LEAKAGE, BULGING, SAGGING, ETC., THROUGH DEFECTIVE OR SHIFTING FORMS.

(Subject of dispute between the Operative Plasterers and Cement Finishers' International Association and the International Hod Carriers, Building and Common Laborers' Union.

Decision Rendered August 2, 1920.

Where finishing tools are not used or required the work shall be done by the laborer.

The filling of voids and other work requiring patching, where finishing tools are used and required, shall be done by the cement finisher.

SETTING AND ALIGNMENT OF TILE AND PORCELAIN BATHROOM ACCESSORIES.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

Illinois Merchants Bank Building. Graham, Anderson, Probst & White, Architects.

HENRY ERICSSON COMPANY

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Decision Rendered December 4, 1920.

In the matter of the controversy between the Tile Layers and Plumbers over Setting and Alignment of Tile and Porcelain Bathroom Accessories, it is decided that all bath and toilet room accessories made of clay products, built in tile-faced walls, shall be the work of the tile setter.

Amended March 10, 1925—"It is the opinion of the Board that the bathroom accessories of enameled cast-iron, known under the trade name of 'Sno-Wite', fall within the decision of December 4, 1920, on the Setting and Alignment of Tile and Porcelain Bathroom Accessories, and that both unions interested in that decision be notified that when such accessories are built into tile walls during construction, the work belongs to the tile setter, and that in all other instances the work is that of the plumber."

ANCHORS FOR BATHROOM ACCESSORIES.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

Decision Rendered November 14, 1923.

All bathroom accessories, except those covered by decision rendered December 4, 1920, placed after finished tile wall surfaces are completed, shall be set by Plumbers and Steam Fitters. When anchors for bathroom accessories are built into finished tile wall construction, the setting of same shall be done by Bricklayers and Masons; and when any such anchors are placed after finished tile wall surfaces are completed, the work shall be done by Plumbers and Steam Fitters.

METAL FLOOR DOMES.

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, the International Union of Wood, Wire and Metal Lathers and the United Brotherhood of Carpenters and Joiners.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers, Lathers and Carpenters over metal floor domes, it is decided that the placing of metal floor domes, whether temporary or permanent, whenever supported by wood props or other wood supports and used as forms for concrete construction, come within the jurisdiction of the Carpenters.

JURISDICTION OVER FOREMEN ON INTERIOR CONCRETE COLUMNS, FOUNDATIONS FOR ENGINE AND MACHINERY BEDS.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union, International Hod Carriers, Building and Common Laborers' Union and the Operative Plasterers and Cement Finishers' International Association.)

Decision Rendered December 4, 1920.

In the matter of the jurisdiction over Foremen on Interior Concrete Columns, Foundations for Engine and Machinery Beds, as contested by the Bricklayers, Hod Carriers and Plasterers, it is the decision of the Board that the work shall be done by the Laborers under the supervision of such skilled workmen as the employer may designate.

ELECTRICAL WORK ON ELEVATORS.

(Rehearing.)

(Subject of dispute between the International Brotherhood of Electrical Workers and the International Union of Elevator Constructors.)

Decision Rendered December 4, 1920.

In the matter of the dispute between the Elevator Constructors and the Electrical Workers on the question of all electrical work on elevators, it is agreed that the electrical work involved in the installation of signal systems, fans, telephones, electric light fixtures and illuminated thresholds and electrical interlocking devices except on automatic elevators, and feed wires to the controller, is awarded to the Electrical Workers.

BISHOPRIC BOARD, WHEN APPLIED AS A SUBSTITUTE FOR LATH AND SHEATHING.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the International Union of Wood, Wire and Metal Lathers.)

Decision Rendered December 4, 1920.

In the matter of the dispute over the installation of Bishopric Board when applied as a substitute for lath, it is the decision of the Board that the work shall be done by the Lathers; where the same is used for sheathing it shall be the work of the Carpenters.

FLAXLINUM KEYBOARD AND INSULATION.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the International Union of Wood, Wire and Metal Lathers.)

Decision Rendered December 4, 1920.

In the matter of the dispute over the installation of Flaxlinum Keyboard and insulation, it is the decision of the Board that when the same is used as a substitute for lath or when any plastic material is to be applied, the work shall be done by the Lathers; when Flaxlinum is used as insulation of sheathing it shall be the work of the Carpenters.

HOLLOW METAL DOORS AND TRIM.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Amalgamated Sheet Metals Workers' International Alliance.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers and Carpenters over Hollow Metal Doors and Trim, it is decided that the hanging of such doors, except sliding doors, the installation of the door frames, the placing of the trim around door or other openings and the placing of all other metal trim, is the work of the Sheet Metal Workers whenever the metal is of No. 10 gauge or lighter.

Decision Rendered March 12, 1921.

In the matter of the controversy between the International Association of Bridge and Structural Iron Workers and the Amalgamated Sheet Metal Workers' International Alliance relative to Hollow Metal Doors and Trim, it is decided that the erection of hollow metal doors, made entirely of ten gauge metal or lighter, except for local re-enforcement, and the installation of the door frames and trim in direct connection with such doors is the work of the Sheet Metal Workers; except that in the case of sliding doors, street entrance and vestibule doors, elevator shipping room and freight doors, and doors used exclusively for fire purposes, the work is that of the Iron Workers. Kalamein or other wood-core doors are not covered by this decision.

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Metal Partitions.

The erection of metal partitions of ten gauge metal or lighter, unless the structural framing of such partitions consists of rolled shapes or drawn tubing is the work of the Sheet Metal Workers. In other cases it is the work of the Iron Workers.

HOLLOW SHEET METAL WINDOW FRAMES AND SASH.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers and the Carpenters over Hollow Sheet Metal Window Frames and Sash, it is decided that the setting of hollow metal window frames and the hanging of hollow metal sash, when such frames and sash are made of No. 10 gauge metal or lighter, is the work of the Sheet Metal Workers.

Decision Rendered March 12, 1921.

In the matter of the controversy between the Amalgamated Sheet Metal Workers' International Alliance and International Association of Bridge and Structural Iron Workers over Hollow Sheet Metal Window Frames and Sash, it is decided that the setting of hollow metal window frames and the hanging of hollow metal sash, when such frames and sash are made of No. 10 gauge metal or lighter, is the work of the Sheet Metal Workers. The Campbell Window and Sash not being of hollow metal, its erection is awarded to the Iron Workers.

METAL DOORS AND TRIM

November 20, 1920—In the matter of the controversy between the Sheet Metal Workers and Carpenters over Hollow Metal Doors and Trim, it is decided that the hanging of such doors, except sliding doors, the installation of the door frames, the placing of the trim around the door or other openings and the placing of all other metal trim, is the work of the Sheet Metal Workers whenever the metal is of No. 10 gauge or lighter.

Note:—This decision to in no way prejudice the claims of the Iron Workers to a whole or part of work.

METAL FRAMES AND SASH.

November 29, 1920—In the matter of the controversy between the Sheet Metal Workers and the Carpenters over Hollow Sheet Metal Window Frames and Sash, it is decided that the setting of hollow metal window frames and the hanging of hollow metal sash, when such frames and sash are made of No. 10 gauge metal or lighter, is the work of the Sheet Metal Workers.

METAL FORMS FOR CONCRETE COLUMNS.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners, Amalgamated Sheet Metal Workers' International Alliance and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers, Carpenters, and Iron Workers over metal forms for concrete columns, it is decided that the setting up of such forms of No. 10 gauge metal or lighter is the work of the Carpenters, and when heavier than No. 10 gauge it is the work of the Iron Workers.

SCHOOL AND THEATRE SEATS, SETTING OF

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, United Brotherhood of Carpenters and Joiners and International Association of Bridge and Structural Iron Workers.)

Decision Rendered March 12, 1921.

In the matter of the controversy between the Amalgamated Sheet Metal Workers' International Alliance, United Brotherhood of Carpenters and Joiners and International Association of Bridge and Structural Iron Workers relative to the setting of school and theatre seats, it is decided that the work in question be awarded to the Carpenters.

SHEET METAL HOPPERS AND SPOUTS IN GRAIN ELEVATORS.

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Amalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners referred to in the foregoing title, it is decided that all metal work relating to Hoppers and Spouts in Grain Elevators when made of ten gauge or lighter metal, including reenforcement of light iron, cold riveted or bolted, be awarded to the Amalgamated Sheet Metal Workers' International Alliance; when heavier than ten gauge the work is awarded to the International Association of Bridge and Structural Iron Workers.

HOISTING, LOWERING AND PLACING OF ELEVATOR MACHINERY.

(Subject of dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers referred to in the foregoing title, it is decided that the Elevator Constructors' International Union be awarded the Hoisting, Lowering and Placing of Elevator Machinery.

GLAZING AS HEREINAFTER DESCRIBED.

(Agreement for avoidance of dispute between Brotherhood of Painters, Decorators and Paperhangers and Bricklayers, Masons and Plasterers' International Union as endorsed by Building Trades Department, A. F of L.)

Decision Rendered July 12, 1922.

In the matter of the subject referred to in the foregoing title, it is the decision of the Board that the following agreement be concurred in:

Agreement entered into by and between the General Executive Board of the Brotherhood of Painters, Decorators and Paperhangers of America, and the General Executive Board of the Bricklayers, Masons and Plasterers' International Union shall take effect December 5, 1910, and remain in force until amended, revised or changed at a meeting between the representatives of both organizations called for this purpose.

Section 1. It is agreed by both parties to this agreement that all plate and window glass, mirrors, beveled plate, rough, ribbed, wire, figured, colored or art glass set in sash, frames, doors, or skylights, constructed of

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wood, sheet metal, iron, stone, or other material and set with putty or moulding, shall be set by the members of the Brotherhood of Painters, Decorators and Paperhangers of America, and that where glass is used as a substitute for ceramic, mosaic, or encaustic tile, and set on floors, walls and ceilings in mortar, cement or other plastic material used to secure such tile in position, shall be set by members of the Bricklayers, Masons and Plasterers' International Union, when cut to size and shape for setting. It is further agreed by the Bricklayers, Masons and Plasters' International Union that all glass delivered on jobs in stock sheets shall be cut to the required size by a member of the Brotherhood of Painters, Decorators and Paperhangers of America.

Section 2. It is agreed by both parties to this agreement that all plate and window glass, mirrors, beveled plate, rough, ribbed, wire, figured, colored, or art glass set in sash, frames, doors, or skylights, constructed of wood, sheet metal, iron, stone, or other material and set with putty or moulding, shall be set by the members of the Brotherhood of Painters, Decorators and Paperhangers of America, and that where glass is used as a substitute for marble in interior finish or decoration, and is carved, cut, polished or rubbed, shall be set by members of the Bricklayers, Masons and Plasters' International Union.

Section 3. Should any differences arise regarding the work as covered by this agreement, a committee appointed by and representing the district council or local union of each organization in tha locality, shall meet and adjust such differences. Should the committees of the local unions fail to agree, an executive officer of each international union shall be requested to attend and assist in the adjustment.

Section 4. It is further agreed that the national officers of both organizations shall insist that all agreements entered into shall be carried out by affiliated unions.

AGREEMENT FOR AVOIDANCE OF DISPUTE BETWEEN UNITED SLATE, TILE AND COMPOSITION ROOFERS AND AMALGAMATED SHEET METAL WORKERS INTERNATIONAL ALLIANCE.

(Endorsed by Seattle Convention, Building Trades Department, November, 1913.)

Decision Rendered July 12, 1922.

In the matter of the subject referred to in the foregoing title, it is the decision of the Board that the following agreement be concurred in:

Upon that portion of the report of the Executive Council under the above caption the committee reported as follows:

"The representatives of the I. A. A. Sheet Metal Works and the United Slate, Tile and Composition Roofers appeared before your committee and requested that they be given an opportunity to reach an agreement. The request was granted and the following represents the agreement reached by the trades in interest:

"This agreement made and entered into at Atlantic City, N. J., July 25, 1913, by and between the Amalgamated Sheet Metal Workers International Alliance, party of the first part, and the United Slate, Tile and Composition Roofers, party of the second part, in pursuance of correspondence and action thereon as found on page 76 of the report of the Proceedings of the Sixth annual Convention of the Building Trades Department whereby the party of the first part agrees to cause its affiliated local unions and their members to respect and observe the trade jurisdiction of the party of the second part as approved by the Building Trades Department of the American Federation of Labor, and refrain from doing any work granted to the said party of the second part in the aforesaid jurisdiction in all towns and localities where the party of the second part has a duly chartered local union.

"The party of the second part agrees to cause all its local unions and their members to observe and respect the jurisdiction of the party of the first part as established and approved by the Building Trades Department of the American Federation of Labor.

OPERATION OF ELEVATOR FOR HOISTING MATERIAL.

(Decision St. Louis Convention, Building Trades Department, A. F. of L., adopted December, 1910. See printed proceedings, page 128.)

Decision Rendered July 12, 1922.

In the matter of the subject referred to in the foregoing title, the following decision is concurred in:

The operation of elevators of all kinds when used for hoisting any material used in the construction of buildings is hereby conceded to the hoisting engineers, affiliated with the International Union of Steam Engineers.

CORRUGATED SHEETING.

(Subject of dispute between International Association of Bridge & Structural Iron Workers and Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered May 26, 1923.

The erection of corrugated metal sheeting on steel frames construction when the sheets are simply end and side lapped is the work of the Iron Workers; the erection of all other corrugated metal sheeting of No. 10 gauge or lighter is the work of the Sheet Metal Workers.

DERRICKS, ERECTION AND HANDLING FOR SETTING STONE

(Subject of dispute between Bricklayers, Masons & Plasterers' International Union and International Association of Bridge & Structural Iron Workers.)

Decision Rendered May 26, 1923.

The stone setter shall have sole jurisdiction over hand derricks in connection with the setting of stone.

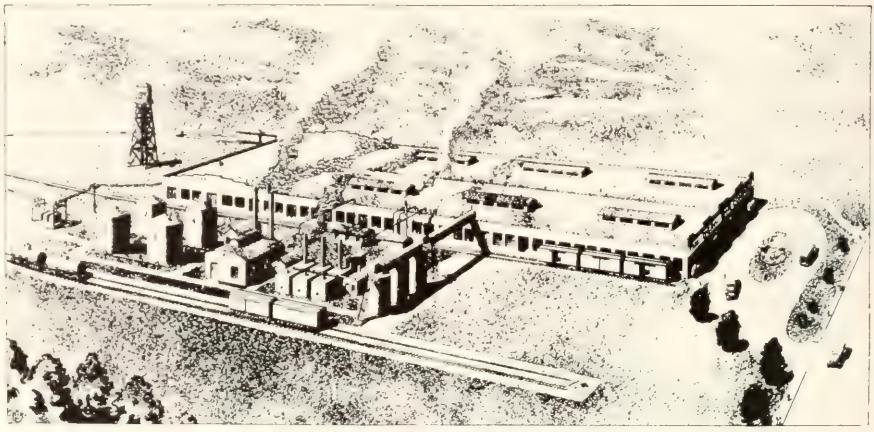
The erection and operation of power derricks for setting stone shall be done by the Iron Workers under the direct supervision of the stone setter, who shall determine the number of men to be employed.

JURISDICTION OVER CORK INSULATION AND SUBSTITUTES THEREFOR.

(Subject of dispute between Operative Plasterers & Cement Finishers' International Association, Bricklayers, Masons & Plasters' International Union, United Slate, Tile & Composition Roofers, Damp & Waterproof Workers' Association, and International Association Heat & Frost Isulators and Asbestos Workers.)

Decision Rendered May 26, 1923.

In the matter of the erection and installation of cork and other insulations used as substitutes the United Brotherhood of Carpenters and Joiners of America shall control all cork and other substitutes when laid dry such as floors, partitions, and ceiling insulation, including the cutting and fitting thereof; the Operative Plasterers' and Cement Finisers' International Association and the Bricklayers, Masons and Plasterers' International Union shall jointly control all cork and substitutes therefor when cement or other plastic materials are used, including the cutting and fitting thereof; on all jobs of cork work laid in asphalt, it shall be permissible for the Laborer to do the work of smearing the asphalt, under the supervision of the mechanic.



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ARTIFICIAL STONE—GRANITE, (DRESSING, ALTERING AND FINISHING.)

(Subject of dispute between Granite Cutters' International Association and Journeymen Stone Cutters' Association.)

Decision Rendered May 26, 1923.

In the matter of dispute between the Granite Cutters' International Association and the Journeymen Stone Cutters' Association relative to artificial stone, the dressing, altering and finishing of artificial stone, cast in imitation of natural stone is the work of the Journeymen Stone Cutters' Association except that when any such artificial stone, by reason of hardness or texture, requires the use of granite cutters' tools for the proper dressing, altering or finishing it is the work of the Granite Cutters' International Association.

FLAT FACED TILE.

(Subject of dispute between Bricklayers, Masons & Plasterers' International Union and United Slate, Tile & Composition Roofers, Damp and Waterproof Workers' Association.)

Decision Rendered May 26, 1923.

In the matter of dispute referred to in the foregoing title the following agreement is concurred in:

Bricklayers, Masons and Plasters' International Union
vs.
United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.

Agreement entered into this 21st day of February, 1911, amended May 26, 1923, by and between duly accredited representatives of the organizations above named, to-wit:

Jurisdiction is hereby conceded the Bricklayers, Masons and Plasterers' International Union over the laying or setting of flat-faced tile of every description when laid in mortars on all flat roofs or promenade roofs.

Jurisdiction is hereby conceded the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association over flat-faced tile of every description, and corrugated tile, when laid in any preparation of asphalt on roofs, flat or otherwise.

FOREMANSHIP OVER CONCRETE WORK ON WALLS, FOUNDATIONS, FOOTINGS, ETC., BELOW THE FIRST FLOOR.

(Subject of dispute between Bricklayers, Masons & Plasterers' International Union, International Hod Carriers, Building & Common Laborers' Union, and Operative Plasterers & Cement Finishers' International Association.)

Decision Rendered May 26, 1923.

In the matter of dispute covered in the foregoing title, it is decided that foremanship over concrete work on walls, foundations, footings, etc., below the first floor shall be done by Laborers under the supervision of such skilled mechanics as the employer may designate.

(Amended February 21, 1924)

In the matter of dispute over concrete construction it is decided the work shall be done by laborers under the supervision of such skilled mechanic as the employer may designate.

CONDUO BASE, INSTALLATION OF

(Subject of dispute between International Brotherhood of Electrical Workers and Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered August 2, 1923.

In the matter of the controversy between the Electrical Workers and the Sheet Metal Workers as to the installation of conduo base, it is decided that the installation of conduo base is the work of the Sheet Metal Workers.

SETTING OF ALBERENE STONE SLABS USED AS DRAIN BOARDS OR BACKS IN CONNECTION WITH SINKS.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

Decision Rendered November 14, 1923.

In the matter of the controversy between the Bricklayers and Masons and the Plumbers and Steam Fitters over the setting of Alberene stone slabs used as drain boards or backs in connection with sinks, it was decided that the setting of Alberene stone slabs used as drain boards or backs in connection with sinks is the work of Plumbers and Steam Fitters.

GUNNITE WORK OR HANDLING CEMENT GUN.

(Subject of dispute between the International Hod Carriers, Building and Common Laborers' Union, Operative Plasterers and Cement Finishers' International Association and Bricklayers, Masons and Plasterers' International Union.)

Decision Rendered February 21, 1924.

In the matter of the dispute referred to in the foregoing title, the following decision was reached:

When work to be performed is to be of the thickness of one and one-half inches or greater, the handling of the cement gun shall be done by the Laborers. When the work is less than one and one-half inches in thickness, the building and control of the nozzle shall be the work of the Plasterers and Cement Finishers.

It is understood that this decision does not allow to the Laborers the right to finish where any finishing tools are required.

The application of a coat of cement mixture by means of the cement gun on steel, as a protection against corrosion, is not included in this decision.

PLASTERING WORK FOR PREPARATION OF WALLS AND CEILINGS FOR TILING.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the Operative Plasterers and Cement Finishers' International Association.)

Decision Rendered February 21, 1924.

After reviewing the controversy in its various phases, the determination is reached that the agreement previously existing between the two organizations affords the most practical plan of adjustment, and the following award is therefore made as the decision of the Board:

Plasterers shall prepare or plaster all walls and ceilings which are to receive tile, except the final setting bed, which shall be applied by the Tile Layers; three bath rooms, vestibule and small halls in single private residences shall be plastered by the tile setters.

SETTING, INSTALLING OR STICKING OF ARTIFICIAL STONE.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and Operative Plasterers and Cement Finishers' International Association.)

Decision Rendered February 21, 1924.

In the matter of the controversy between the Bricklayers and Masons and the Plasterers and Cement Finishers over the setting, installing or sticking of artificial stone, it is decided that the setting, installing or sticking of all artificial stone which is reinforced with burlap or other fibrous material, whether cast or fabricated in shop or on the job, is the work of the Plasterers and Cement Finishers; and the setting, installing and sticking of all artificial stone which is not reinforced with burlap or other fibrous material is the work of the Bricklayers and Masons.

Jewelers Building, Chicago — Glaver & Dinkelberg, Architects

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MECHANICS LIEN LAW

State of Illinois

1. "Contractor" defined—lien upon real estate for material or labor furnished.
2. Liens for labor or material furnished by mistake.
3. Husband and wife.
4. Breach of contract by owner—recovery of material—other provisions.
5. Claims of sub-contractor—notice of to owner—owner's duty — contractor's liability—exceptions.
6. Time for completing contract.
7. Limitation as against third parties—claim for lien—proof of delivery sufficient.
8. Assigning liens or claims for liens.
9. Suit—how brought—joint suits—cross bill—dismissal—surprise—limitation.
10. Personal representatives — death of parties in interest.
11. "Parties in interest" defined—dismissal —notice.
12. Practice—powers of court—receivers.
13. Practice—answer — defense — counter claim.
14. Trials—delay—order for sale.
15. Preferences.
16. Incumbrances—pro rata benefits.
17. Costs—attorney fees.
18. Sales of estates—partial sales.
19. Proceeds of sale—application—preferences—deficiency and surplus.
20. Redemption.
21. "Sub-contractor" defined — preferences —limit of ability—abandonment of contract.
22. Partner after contract—statement of sub-contractor—failure—penalty.
23. Lien against public funds—public improvements—liability and duty of official.
24. Notice by sub-contractor — agents, architects and superintendents to be notified—form of notice.
25. Notice to non-residents.
26. Preferential liens.
27. Owners' duty after notice—preferences.
28. Suits by sub-contractor—proceedings.
29. Judgment before justice—transcript—executions.
30. General settlement—procedure.
31. Failure to complete contract—owner's liability to sub-contractor.
32. Wrongful payment of owner to contractor.
33. Limitation as to suit of sub-contractor.
34. General provisions.
35. Neglect—penalty.
36. Wrongful sale or removal of material —penalty.
37. Liens against water craft.
38. Filing claims—circuit clerk's duties—fees.
39. Construction of Act.
40. Repeals of Act of 1895.

AN ACT

To Revise the Law in Relation to Mechanics' Liens; To Whom, What For and When Lien Is Given; Who Is a Contractor; Area Covered by and Extent of Lien; When the Lien Attaches. (Approved May 18, 1903; in Force July 1, 1903; as Amended by Act Approved June 16, 1913, in Force July 1, 1913.)

Section 1. **When Lien Given.)** Be it Enacted by the People of the State of Illinois, Represented in the General Assembly: That any person who shall by any contract or contracts, express or implied, or partly expressed or implied, with the owner of a lot or tract of land, or with one whom such owner has authorized or knowingly permitted to contract for the improvement of, or to improve the same, furnish material, fixtures, apparatus or machinery, forms or form work used in the process of construction where cement, concrete or like material is used for the purpose of or in the building, altering, repairing or ornamenting any house or other building, walk or sidewalk, whether such walk or sidewalk be on the land or bordering thereon, driveway, fence or improvement or appurtenances thereto on such lot or tract of land or connected therewith, and upon, over or under a sidewalk, street or alley adjoining; or fill, sod or excavate such lot or tract of land, or do landscape work thereon or therefor; or raise or lower any house thereon or remove any house thereto; or perform sevices as an architect or as a structural engineer for any such purpose; or furnish or perform labor or services as superintendent, timekeeper, mechanic, laborer or otherwise, in the building, altering, repairing or ornamenting of the same; or furnish material, fixtures, apparatus, machinery, labor or services, forms or form work used in the process of construction where concrete, cement or like material is used, on the order of his agent, architect, structural engineer or superintendent having charge of the improvements, building, altering, repairing or ornamenting the same, shall be known under this Act as a contractor, and shall have a lien upon the whole of such lot or tract of land and upon the adjoining or adjacent lots or tracts of land of such owner constituting the same premises and occupied or used in connection with such lot or tract of land as a place of residence or business; and in case the contract relates to two or more buildings, on two or more lots or tracts of land, upon all such lots and tracts of land and improvements thereon for the amount due to him for such material, fixtures, apparatus, machinery, services or labor, and interest from the date the same is due. This lien shall extend to an estate in fee, for life, for years, or any other estate or any right of redemption, or other interest which such owner may have in the lot or tract of land at the time of making such contract or may subsequently acquire therein, and shall be superior to any right of dower of husband or wife in said premises, provided the owner of such dower interest had knowledge of such improvement and did not give written notice of his or her objection to such improvement before the making thereof; nor shall the taking of additional security by the contractor or sub-contractor be a waiver of any right of lien which he may have by virtue of this Act, unless made a waiver by express agreement of the parties; and this lien shall attach as the date of the contract. (As amended by Act approved June 28, 1919.)

Section 2. **Liens for Work or Materials by Mistake Put Upon Land Other Than the Contracting Parties.)** Any person furnishing services, labor or material for the erection of a building, or structure, or improvement, by mistake, upon land owned by another than the party contracting as owner, shall have a lien for such services, labor or material upon such building, or structure, or improvement, and the court, in the enforcement of such lien, shall order and direct such building, structure or improvement to be separately sold under its decree, and the purchaser may remove the same within such reasonable time as the court may fix.

Section 3. **Liens for Work or Materials Under Contract with Husband on Land of Wife.)** If any such services or labor are performed upon or materials are furnished for lands belonging to any married woman, with her knowledge and not against her protest in writing, as provided in Section 1 of

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this Act, in pursuance of a contract with the husband of such married woman, the person furnishing such labor or materials shall have a lien upon such property, the same as if such contract had been made with (the) married woman, and in case the title to such lands upon which improvements are made is held by husband and wife jointly, the lien given by this Act shall attach to such lands and improvements, if the improvements be made in pursuance of a contract with both of them, or in pursuance of a contract with either of them, and in all such cases no claim of homestead right set up by a husband or wife shall defeat the lien given by this Act.

Section 4. **Breach of Contract by Owner—Recovery for Material—Partial Performance—Quantum Meruit—Right to Reclaim—Unused Material.)** When the owner of the land shall fail to pay the contractor moneys justly due him under the contract at the time when the same should be paid, or fails to perform his part of the contract in any other manner, the contractor may discontinue work, and the contractor shall not be held liable for any delay on his part during the period of, or caused by, such breach of contract on the part of the owner; and if, after such breach for the period of ten days, the owner shall fail to comply with his contract, the contractor may abandon the work, and in such case the contractor shall be entitled to enforce his lien for the value of what has been done, and the court shall adjust his claim and allow him a lien accordingly. In such cases all persons furnishing material which has not been incorporated in the improvement shall have the right to take possession of and remove the same if he so elects.

Section 5. **Contractors to Notify Owners of Sub-Contracts and Amounts of Their Claims—Owner's Duty with Regard Thereto and Rights in Case of Default—Contractor's Liability for Failure to Give Statement—Contractors to Whom This Section Does Not Apply.)** It shall be the duty of the contractor to give to the owner, and the duty of the owner to require of the contractor, before the owner or his agent, architect or superintendent, shall pay or cause to be paid to said contractor or to his order any moneys or other consideration due or to become due such contractor, or make or cause to be made to such contractor any advancement of any money or any other consideration, a statement in writing, under oath or verified by affidavit, of the names of all parties furnishing materials and labor, and of the amounts due or to become due each. Merchants and dealers in materials only shall not be required to make statements herein provided for.

Section 6. **Time for Completion of Contract.)** In no event shall it be necessary to fix or stipulate in any contract a time for the completion or a time for payment in order to obtain a lien under this Act: Provided, that the work is done or material furnished within three years from the commencement of said work or the commencement of furnishing said materials.

Section 7. **Limitations as Against Third Parties—Claim for Lien—What Shall Consist of—When Claim May be Filed and When Amended—As to Errors in—Proof of Delivery of Material, Not Use, Sufficient—Delivery of Material at One Building Good for All Buildings.)** No contractor shall be allowed to enforce such lien against or to the prejudice of any other creditor or incumbrancer or purchaser, unless within four months after completion, or if extra or additional work is done or material is delivered therefor within four months after the completion of such extra or additional work or the final delivery of such extra or additional material, he shall either bring suit to enforce his lien therefor or shall file with the clerk of the Circuit Court in the county in which the building, erection or other improvement to be charged with the lien is situated, a claim for lien, verified by the affidavit of himself, or his agent or employee, which shall consist of a brief statement of the contract, the balance due after allowing all credits, and a sufficiently correct description of the lot, lots or tracts of land to identify the same. Such claim for lien may be filed at any time after the contract is made, and as to the owner may be filed at any time after the contract is made and within two years after the completion of said contract, or the completion of any extra work or the furnishing of any extra material thereunder, and as to such owner may be amended at any time before the final decree. No such lien shall be defeated to the proper amount thereof because of an error or overcharging on the part of any person claiming a lien therefor under this Act unless it shall be shown that such error or overcharge is made with intent to defraud; nor shall any such lien for material be defeated because of lack of proof that the material after the delivery thereof, actually entered into the construction of such building or improvement, although it be shown that such material was not actually used in the construction of such building or improvement: .Provided, it is shown that such material was delivered either to said owner or his agent for such building or improvement, to be used in said building or improvement, or at the place where said building or improvement was being constructed, for the purpose of being used in construction or for the purpose of being employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed forms or form work where concrete, cement or like material is used, in whole or in part: And, provided, further, that in case of the construction of a number of buildings under contract between the same parties, it shall be sufficient in order to establish such lien for material, if it be shown that such material was in good faith delivered at one of the said buildings for the purpose of being used in the construction of any one or all of such buildings, or delivered to the owner or his agent for such buildings, to be used therein; and such lien for such material shall attach to all of said buildings, together with the land upon which the same are being constructed, the same as in a single building or improvement: And, provided, further, that in the event the contract relates to two or more buildings on two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be included in one statement of claim for a lien. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 8. **Assignability of Liens or Claims for Liens—Rights of Assignee.)** All liens or claims for lien which may arise or accrue under the terms of this Act shall be assignable, and proceedings to enforce such liens or claims for lien may be maintained by and in the name of the assignee, who shall have as full and complete power to enforce the same as if such proceedings were taken under the provisions of this Act by and in the name of the lien claimant.

Section 9. **When, How and in What Court Suit May be Brought—Two or More Lien Holders May Join in Bringing Suit—Answers Stand as Cross-Bills—Original Bill Cannot be Dismissed Without Consent of Parties—Lien Claimants May Contest Each Other's Claims Without Formal Issues of Record—Rights of in Case of Surprise—Limitation.)** If payment shall not be made to the contractor having a lien by virtue of this Act of any amount due when the same becomes due, then such contractor may bring suit to enforce his lien by bill or petition in any court of competent chancery jurisdiction in the county where the improvement is located, and in the event that the contract relates to two or more buildings or two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be in-

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cluded in one bill or petition. Any two or more persons having liens on the same property may join in bringing such suit, setting forth their respective rights in their bill or petition; all lien claimants not made parties thereto may, upon application, become defendants and enforce their liens by answer to the bill or petition in the nature of an intervening petition, and the same shall be taken as a cross-bill against all the parties to such suit; and the said bill or petition shall not thereafter be dismissed as to any such lien claimant, or as to the owner or owners of the premises without the consent of such lien claimant. The complainant or petitioner, and all defendants to such bill or petition may contest each other's right without any formal issue of record made up between them other than that (shown) upon the original bill or petition, as well with respect to the amount due as to the right to the benefit of the lien claimed: Provided, that if by such contest by co-defendants any lien claimants be taken by surprise, the court may, in its discretion, as to such claim grant a continuance. The court may render judgment against any party summoned and failing to appear, as in other cases of default. Such suit shall be commenced or answer filed within two years after the completion of the contract, or completion of the extra or additional work, or furnishing of extra or additional material thereunder.

Section 10. **Personal Representatives—Death of Parties in Interest.)** Suits may be instituted under the provisions of this Act in favor of administrators or executors, and may be maintained against the representatives in the interest of those against whom the cause of action accrued, and in suits instituted under the provisions of this Act, the representatives of any party who may die pending the suit shall be made parties.

Section 11. **Who Are Parties in Interest—How and When Made—Or May Become Parties to Suit—Publication, Service of Process on Non-Resident—Claims Not Due, Etc.—Pleading, Requisites of Bill or Petition—Diligence Required in Prosecuting Claim—When and How Party Bringing Suit May Dismiss Same.)** The bill or petition shall contain a brief statement of the contract or contracts on which it is founded, the dates when made and when completed, if not completed, why, and it shall also set forth the amount due and unpaid, a description of the premises which are subject to the lien, and such other facts as may be necessary to a full understanding of the rights of the parties. Where plans and specifications are by reference made a part of the contract, it shall not be necessary to set the same out in the pleadings or as exhibits, but the same may be produced on the trial of the suit. The complainant or petitioner shall make all parties interested, of whose interest he is notified or has knowledge, parties defendant, and summons shall issue and service thereof be had as in suits in chancery; and when any defendant resides or has gone out of the State, or on inquiry cannot be found, or is concealed within the State, so that process cannot be served on him, the complainant or petitioner shall cause a notice to be given to him in like manner and upon the same conditions as is provided in suits in chancery, and his failure to so act with regard to summons or notice shall be ground for judgment or decree against him as upon the merits. The same rule shall prevail with cross-petitioners with regard to any person of whose interest they have knowledge, and who are not already parties to the suit or action. Parties in interest, within the meaning of this Act, shall include persons entitled to liens thereunder, whose claims are not, as well as are, due at the time of the commencement of suit, and such claim shall be allowed subject to a reduction of interest from the date of judgment to the time the claim is due; also all persons who may have any legal or equitable claim to the whole or any part of the premises upon which a lien may be attempted to be enforced under the provisions thereof, or who are interested in the subject matter of the suit. Any such persons may, on application to the court wherein the suit is pending, be made or become parties at any time before final judgment. No action or suit under the provisions of this Act shall be voluntarily dismissed by the parties bringing the same without due notice to all parties before the court and leave of court upon good cause shown and upon terms named by the court.

Section 12. **Practice—Powers of Courts—When Receivers May be Appointed.)** The court shall permit amendments to any part of the pleadings, and may issue process, make all orders requiring parties to appear, and requiring notice to be given, that are or may be authorized in proceedings in chancery, and shall have the same power and jurisdiction of the parties and subject matter, and the rules of practice and proceedings in such cases shall be the same as in other cases in chancery, except as is otherwise provided in this Act. The court shall have power to appoint receivers for property on which liens are sought to be enforced in the same manner, for the same causes and for the same purposes, as in cases of foreclosure of mortgages, as well as to complete any unfinished building where the same is deemed to be to the best interest of all the parties interested.

Section 13. **Practice—Answer—Defense—Right to Recover on Counter Claim.)** Defendant shall answer the bill or petition under oath, unless the oath is waived by the claimant or petitioner. The owner shall be entitled to make any defense against the contractor by way of set-off, recoupment or counter claim that he could in any action at law, and shall be entitled to the same right of recovery on proof of such in excess of the claim of the contractor against the contractor only, but for matters not growing out of the contract such recovery shall be made without prejudice to the rights of the subcontractors thereunder for payment of the contract price or fund; and in event that the court shall find, in any proceeding in chancery, that no right to a lien exists, the contractor shall be entitled to recover against the owner as at law, and the court shall render judgment as at law for the amount which the contractor is entitled to, together with costs, in the discretion of the court. In any proceedings to enforce a lien, it shall only be necessary for all persons seeking a lien on account of wages due for labor to file in such proceedings an affidavit, giving the amount due, between what dates the same was performed and the kind of labor performed, and the court shall direct the amount due for wages as therein specified to be paid within a short day to be fixed by the court, unless within ten days after the filing of said claim for wages the amount claimed is contested by the owner or some other party to the suit, and in order to contest the amount due for wages it shall be necessary for the party making such contest to file an affidavit in which he shall state the defense he has to the allowance of such claim, and the court shall proceed at once to hear such evidence as the parties may adduce, and determine the merits as to the allowance of such claim for wages, and in the event that the allowance for wages is not paid within the time fixed by the court, then the court shall order the premises sold to pay such amount, in such manner as the court shall direct.

Section 14. **Trials—Parties Ready Not to be Delayed—When Court May Delay Order for Sale or Distribution.)** In no case shall the want of preparation for trial of one claim delay the trial in respect to others, but trial shall be had upon issues between such parties as are prepared, without reference to issues between other parties; and when one creditor shall have obtained a decree or judgment for the amount due, the court may order a sale of the premises on which the lien operates, or a part thereof, so as to satisfy the decree or judgment:

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Provided, that the court may, for good cause shown, delay making any order for sale or distribution until the rights of all the parties in interest are ascertained and settled by the court.

Section 15. **Preference to Laborers—No Preference to First Contractors.)** Upon all questions arising between different contractors having lien under this Act, no preference shall be given to him whose contract was made first, except the claim of any person for wages by him personally performed shall be a preferred lien.

Section 16. **Incumbrances—Apportionment—On Improvements Made After Record of Incumbrance—Lien Holders Have Pro Rata Benefit in What Owner Pays For—Fraudulent Incumbrances—Disposition of.)** No incumbrance upon land, created before or after the making of the contract under the provisions of this Act, shall operate upon the building erected, or materials furnished, until a lien in favor of the persons having done work or furnished material shall have been satisfied, and upon questions arising between incumbrances and lien creditors, all previous incumbrances shall be preferred to the extent of the value of the land at the time of making of the contract, and the lien creditor shall be preferred to the value of the improvements erected on said premises, and the court shall ascertain by jury or otherwise, as the case may require, what proportion of the proceeds of any sale shall be paid the several parties in interest. All incumbrances, whether by mortgage, judgment or otherwise, charged and shown to be fraudulent, in respect to creditors, may be set aside by the court, and the premises freed and discharged from such fraudulent incumbrance.

Section 17. **Costs—How Taxed—Attorneys' Fees.)** The costs of proceedings, as between all parties to the suit, shall be taxed equitably against the losing parties, and where taxed against more than one party shall be so taxed against all in favor of the proper party, but equitably as between themselves; and the costs, as between creditors aforesaid in contests relative to each other's claims, shall be subject to the order of the court, and the same rule shall prevail in respect to costs growing out of the proceedings against and between incumbrances. In all cases where liens are enforced, the court shall, in its discretion, order a reasonable attorney's fee taxed as a part of the costs in favor of the lien creditor.

Section 18. **What Estate to be Sold—Manner of Making Sales, When Part May be Sold.)** Whatever right or estate such owner had in the land at the time of making the contract may be sold in the same manner as other sales of real estate are made under decrees in chancery. If any part of the premises can be separated from the residue, and sold without damage to the whole, and if the value thereof is sufficient to satisfy all the claims proved in the cause, the court may order a sale of that part.

Section 19. **Proceeds of Sale—Application of Pro Rata—Labor Claims Preferred—Deficiency Decrees—Excess, to Whom Paid.)** The court shall ascertain the amount due each lien creditor, and shall direct the application of the proceeds of sale to be made to each in proportion to their several amounts, according to the provisions of this Act, but the claims of all persons for labor, as provided in Section fifteen (15) shall first be paid. If, upon making sale under this Act, of any or all premises, the proceeds of such sale shall not be sufficient to pay all claims of all parties, according to their rights, the decree shall be credited by the amount of said sale, and execution may issue in favor of any creditor whose claims are not satisfied for the balance due as upon a deficiency decree in the foreclosure of a mortgage in chancery, and such deficiency decree shall be a lien upon all real estate and other property of the party against whom it is entered to the same extent and under the same limitations as a judgment at law; and in cases of excess of sales over the amount of the decree, such excess be paid to the owner of the land, or to the person who may be entitled to the same, under the direction of the court.

Section 20. **Redemption.)** Upon all sales under this Act, the right of redemption shall exist in favor of the same persons, and may be made in the same manner as is or may be provided for redemption of real estate from sales under judgments and executions at law.

Section. 21. **Sub-Contractors — Liens of Sub-Contractors—Who Are—Extent of Their Liens Superior to Creditors or Contractors on Money Due Contractors—Duty of Owner and Contractor to File Notice of Waiver of Lien—Limit of Owner's Liability—Owner Liable for Sub-Contracts Performed After Notice Thereof—Rights of in Case Contractor Default May Complete, If Contractor Abandons.)** Every mechanic, workman or other person who shall furnish any materials, apparatus, machinery or fixtures, or furnish or perform services or labor for the contractor, or shall furnish any material to be employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed form or form work where concrete, cement or like material is used in whole or in part, shall be known under this Act as a sub-contractor, and shall have a lien for the value thereof, with interest on such amount from the date the same is due, from the same time, on the same property as provided for the contractor, and, also, as against the creditors and assignees, and personal and legal representatives of the contractor, on the material, fixtures, apparatus or machinery furnished, and on the moneys or other considerations due or to become due from the owner under the original contract. If the legal effect of any contract between the owner and contractor is that no lien or claim may be filed or maintained by any one, such provision shall be binding; but the only admissible evidence thereof as against a sub-contractor or material man, shall be proof of actual notice thereof to him before any labor or material is furnished by him; or proof that a duly written and signed stipulation or agreement to that effect has been filed in the office of the recorder of deeds of the county or counties where the house, building or other improvement is situated, prior to the commencement of the work upon such house, building or other improvement, or within ten days after the execution of the principal contract or not less than ten days prior to the contract of the sub-contractor or material man. And the recorder of deeds shall record the same at length in the order of time of its reception in books provided by him for that purpose, and the recorder of deeds shall index the same, in the name of the contractor and in the name of the owner, in books kept for that purpose, and also in the tract or abstract book of the tract, lot, or parcel of land, upon which said house, building or other improvement is located, and said recorder of deeds shall receive therefor a fee, such as is provided for the recording of instruments in his office.

In no case, except as hereinafter provided, shall the owner be compelled to pay a greater sum for or on account of the completion of such house, building or other improvement than the price or sum stipulated in said original contract or agreement, unless payment be made to the contractor or to his order, in violation of the rights and interests of the persons intended to be benefited by this Act: Provided, if it shall appear to the court that the owner and contractor fraudulently, and for the purpose of defrauding sub-contractors fixed an unreasonably low price in their original contract for the erection or repairing of such house, building or other improvement, then the

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court shall ascertain how much of a difference exists between a fair price for labor and material used in said house, building or other improvement, and the sum named in said original contract, and said difference shall be considered a part of the contract and be subject to a lien. But where the contractor's statement, made as provided in Section five (5), shows the amount to be paid to the sub-contractor, or party furnishing material, or the sub-contractor's statement, made pursuant to Section twenty-two (22), shows the amount to become due for material; or notice is given to the owner, as provided in Sections twenty-four (24) and twenty-five (25), and thereafter such subcontract shall be performed, or material to the value of the amount named in such statements or notice, shall be prepared for use and delivery, or delivered without written protest on the part of the owner previous to such performance or delivery, or preparation for delivery, then, and in any of such cases, such sub-contractor or party furnishing or preparing material, regardless of the price named in the original contracts, shall have a lien therefor to the extent of the amount named in such statements or notice. Also, in case of default or abandonment by the contractor, the sub-contractor or party furnishing material, shall have and may enforce his lien to the same extent and in the same manner that the contractor may under conditions that arise as provided for in Section four (4) of this Act, and shall have and may exercise the same rights as are therein provided for the contractor. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 22. **Where Partners Taken in After Contract—Lien for Material Furnished to Sub-Contractor—Lien of Sub-Contractor—Statement of Sub-Contractor to Owner or Contractor—Penalty for Failure to Give Statement.)** Whenever, after a contract has been made, the contractor shall associate one or more persons as partners or joint contractors, in carrying out the same, or any part thereof, the lien for materials or labor furnished by a sub-contractor to such contractor and his partners or associates, as originally agreed upon, shall continue the same as if the sub-contract had been made with all of said partners. When the contractor shall sub-let his contract, or a specified portion thereof, to a sub-contractor, the party furnishing material to or performing labor for such sub-contractor shall have a lien therefor and may enforce his lien in the same manner as is herein provided for the enforcement of liens by sub-contractors. Any sub-contractor shall, as often as requested in writing by the owner or contractor, or the agent of either, make out and give to such owner, contractor or agent, a statement of the persons furnishing material and labor, giving their names and how much, if anything, is due or to become due to each of them, and which statement shall be made under oath if required. If any sub-contractor shall fail to furnish such statement within five (5) days after such demand, he shall forfeit to such owner or contractor the sum of fifty ($50) dollars for every offense, which may be recovered in an action of debt before a justice of the peace, and shall have no right of action against either owner or contractor until he shall furnish such statement, and the lien of such sub-contractor shall be subject to the liens of all other creditors.

Section 23. **Lien Against Fund Due or to Become Due—Contractors for Public Improvements, Notice—Duty and Liability of Officer Notified.)** Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for any county, township, school district, city or municipality in this State, shall have a lien on the money, bonds or warrants due or to become due such contractor under such contract: Provided such person shall, before payment or delivery thereof is made to such contractor, notify the official or officials of the county, township, school district, city or municipality whose duty it is to pay such contractor of his claim by a written notice; and, provided further, that such lien shall attach only to that portion of such money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the county, township, school district, city or municipality, as the case may be, at the time of such notice. It shall be the duty of any such official so notified to withhold a sufficient amount to pay such claim until the same is admitted by the contractor, or adjusted by the agreement of the parties, or there has been an adjudication of the same in a court of competent jurisdiction, and thereupon to pay the amount so determined to be due such claimant, if any, and to that end the said county, township, school district, city or municipality, or any of the other parties interested may institute suit in the same manner as is provided herein in case of privately owned real estate to determine the rights of the parties when such claim is filed.

Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for the State, may have a lien on the money, bonds or warrants due or about to become due such contractor under the contract, by filing with the official whose duty it is to pay such contractor a sworn statement of the claim showing with particularity the several items and the amount claimed to be due on each; but the lien shall attach to only that portion of the money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the State.

The person so claiming a lien shall, within thirty (30) days after filing notice with the State official, commence proceedings by bill in equity for an accounting, making the contractor to whom such material, apparatus, fixtures, machinery or labor was furnished, party defendant, and shall, within the same period notify the official of the State of the commencement of such suit by delivering to him a certified copy of the bill filed: provided, that suit shall be commenced and a copy of the bill served upon the State official not less than fifteen (15) days before the date when the appropriation from which such money is to be paid, will lapse. It shall be the duty of the State official after the sworn statement has been filed with him, to withhold payment of a sum sufficient to pay the amount of such claim, for the period limited for the filing of suit, unless otherwise notified by the person claiming the lien.

Upon the expiration of this period the money, bonds or warrants so withheld shall be released for payment to the contractor unless the person claiming the lien shall have instituted proceedings and served the official of the State with the certified copy of the bill as herein provided, in which case, the amount claimed shall be withheld until the final adjudication of the suit is had: Provided, the State official may pay over to the clerk of the court in which such suit is pending, a sum sufficient to pay the amount claimed to abide the result of such suit and be distributed by the clerk according to the decree rendered.

Any payment so made to such claimant or to the clerk of the court shall be a credit on the contract price to be paid to such contractor. Any officer violating the duty hereby imposed upon him shall be liable on his official bond to the claimant serving such notice for the damages resulting from such violation, which may be recovered in an action at law in any court of competent jurisdiction. There shall be no preference between the persons serving such notice, but all shall be paid pro rata in proportion to the amount due under their respective contracts. (As amended by Act approved June 28, 1919.)

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Section 24. **Notice to the Owner by Sub-Contractor—Limitation for Service of—May be Served on Owner, Agent, Architect or Superintendent in Charge—Duties and Liabilities of Agents, Architect and Superintendent Notified—Excuse of Notice—Sub-Contractors Protected to Amount Named in—Form of.)** Sub-contractors, or party furnishing labor or materials, may at any time after making his contract with the contractor, and shall within sixty (60) days after the completion thereof; or, if extra or additional work or material is delivered thereafter, within sixty (60) days after the date of completion of such extra or additional work or final delivery of such extra or additional material, cause a written notice of his claim and the amount due or to become due thereunder, to be personally served on the owner or his agent or architect, or the superintendent having charge of the building or improvement: Provided, such notice shall not be necessary, when the sworn statement of the contractor or sub-contractor provided for herein shall serve to give the owner notice of the amount due and to whom due, but where such statement is incorrect as to the amount, the sub-contractor or material man named shall be protected to the extent of the amount named herein as due or to become due to him.

The form of such notice may be as follows: To (name of owner): You are hereby notified that I have been employed by (name of contractor) to (state here what was the contract or what was done, or to be done, or what the claim is for) under his contract with you, on your property at (here given substantial description of the property) and that there was due to me, or is to become due (as the case may be) therefor, the sum of ..... dollars.

Dated at .....this.....
day of....., A. D.....

Signature.....

Section 25. **Notice to Non-Resident Owner by Filing Claim with Circuit Court, What Claim Shall Consist of—When Itemized Account Not Necessary.)** In all cases where the owner, agent, architect or superintendent cannot, upon reasonable diligence, be found in the county in which said improvement is made, or shall not reside therein, the sub-contractor or person furnishing materials, fixtures, apparatus, machinery, labor or services may give notice by filing in the office of the clerk of the Circuit Court against the person making the contract and the owner a claim for lien verified by the affidavit of himself, agent or employee, which shall consist of a brief statement of his contract or demand, and the balance due after allowing all credits, and a sufficient correct description of the lot, lots or tract of land to identify the same. An itemized account shall not be necessary.

Section 26. **Lien of Laborers Preferred—Limitation as to Laborer's Notice.)** The claim of any person for wages as a laborer under Sections fifteen, twenty-one and twenty-two of this Act shall be a preferred lien.

Section 27. **Owner's Duty to Retain and Pay Money After Notice—Preference to Laborers—Manner in Which He Shall Make Payment—Liability of Owners.)** When the owner or his agent is notified as provided in this Act, he shall retain from any money due or to become due the contractor, an amount sufficient to pay all demands that are or will become due such sub-contractor, tradesman, materialmen, mechanic or workmen of which claim he is notified, and shall pay over the same to the parties entitled thereto.

Such payments shall be as follows:

First—All claims for wages shall be paid in full.

Second—The claims of tradesmen, materialmen and sub-contractors, who are entitled to liens, pro rata, in proportion to the amount due them respectively. All payments made as directed shall, as between such owner and contractor, be considered the same as if paid to such contractor. Any payment made by the owner to the contractor after such notice, without retaining sufficient money to pay such claims, shall be considered illegal and made in violation of the rights of the laborers and sub-contractors, and the rights of such laborers and sub-contractors to a lien shall not be affected thereby, but the owner shall not be held liable to any laborer and sub-contractor or other person whose name is omitted from the statement provided for in Sections five (5) and twenty-two (22) of this Act, nor for any larger amount than the sum therein named as due such person (provided such omission is not made with the knowledge or collusion of the owner), unless previous thereto or to his payment to his contractor, he shall be notified, as herein provided, by such person of their claim and the true amount thereof.

Third—The balance, if any, to the contractor.

Section 28. **Suits to Enforce Lien by Sub-Contractors—When Can be Brought, Pleadings, Action at Law Against Owner and Contractor—Proceedings, Extent of Owner's Liability.)** If any money due to the laborers or sub-contractor be not paid within ten (10) days after his notice is served, as provided in Sections five (5), twenty-four (24), twenty-five (25) and twenty-seven (27), then such person may either file his petition and enforce his lien as hereinbefore provided for the contractor in Sections nine (9) to twenty (20), inclusive, of this Act, except as to the time within which suit shall be brought, or he may sue the owner and contractor jointly for the amount due him in any court having jurisdiction of the amount claimed to be due, and a personal judgment may be rendered therein, as in other cases. In such actions at law, as in suits to enforce the lien, the owner shall be liable to the plaintiff for no more than the pro rata share that such person would be entitled to with other sub-contractors out of the funds due to the contractor from the owner under the contract between them, except as hereinbefore provided for laborers, and such action at law shall be maintained against the owner only in case the plaintiff establishes his right to the lien. All suits and actions by sub-contractors shall be against both contractor and owner jointly, and no decree or judgment shall be rendered therein until both are duly brought before the court by process of publication, and in all courts, including actions before a justice of the peace and police magistrate, such process may be served and publication made as to all persons except the owners, as in suits in chancery. All such judgments, where the lien is established, shall be against both jointly, but shall be enforced against the owner only to the extent that he is liable under his contract as by this Act provided, and shall recite the date from which the lien thereof attached according to the provisions of Sections one (1) to twenty (20) of this Act, but this shall not preclude a judgment against the contractor personally, where the lien is defeated.

Section 29. **Judgment Before Justice of the Peace—When Transcript of May be Filed—Execution Thereon—Liens Thereof.)** If the execution issued on a judgment obtained before a justice of the peace or police magistrate shall be returned not satisfied, a transcript of such judgment may be taken to the Circuit Court and spread upon the records thereof, and execution issued thereon as in other cases except that the lien of the same shall be preserved as a preferred lien on the property improved from the date recited in the judgment, and enforced thereon the same as if a decree had been rendered by the Circuit Court in a suit to enforce such lien under the provisions of this Act.

Section 30. **Proceedings for General Settlement — Interpleader — How Liens and Claims Cut Off and Judgments Thereon Stayed in Such Proceedings.)** If there are several liens under Sections twenty-one (21) and twenty-two (22) upon the same prem-

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ises, and the owner or any person having such a lien shall fear that there is not a sufficient amount coming to the contractor to pay all such liens, such owner or any one or more persons having such lien may file his or their bill or petition in the Circuit Court of the proper county, stating such fact and such other facts as may be sufficient to a full understanding of the rights of the parties. The contractor and all persons having liens upon or who are interested in the premises, so far as the same are known to or can be ascertained by the claimant or petitioner upon diligent inquiry, shall be made parties. Upon the hearing the court shall find the amount coming from the owner to the contractor, and the amount due to each of the persons having liens, and in case the amount found to be coming to the contractor shall be insufficient to discharge all the liens in full, the amount so found in favor of the contractor shall be divided between the persons entitled to such liens pro rata after the payments of all claims for wages in proportion to the amount so found to be due them respectively. If the amount so found to be coming to the contractor shall be sufficient to pay the liens in full, the same shall be so ordered. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under the requirements as are directed in Section eleven (11) of this Act, and all persons who shall be duly notified of such proceedings and who shall fail to prove their claims, whether the same be in judgment against the owner or not, shall forever lose the benefit of and be precluded from their liens and all claims against the owner. Upon the filing of such bill or petition the court may, on the motion of any person interested, and shall, upon final decree, stay further proceedings upon any suit against the owner on account of such liens, and costs in such cases shall be adjusted as provided for in Section seventeen (17).

Section 31. **Failure to Complete Contract by Contractor—Requisites and Manner of Sub-Contractor's Suit in Case of—Owner's Liability in Case of.)** Should the contractor, for any cause, fail to complete his contract, any person entitled to a lien as aforesaid may file his petition in any court of record against the owner and contractor, setting forth the nature of his claim, the amount due, as near as may be, and the names of the parties employed on such house or other improvements subject to liens; and a notice of such suit shall be served on the persons therein named, and such as shall appear shall have their claim adjudicated. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under like requirements as are directed in Section eleven (11) of this Act.

Section 32. **Payment of Owner to Contractor—When Wrongful.)** No payments to the contractor or to his order of any money or other considerations due or to become due to the contractor shall be regarded as rightfully made, as against the sub-contractor, laborer or party furnishing labor or materials, if made by the owner without exercising and enforcing the rights and powers conferred upon him in Sections five (5) and twenty-two (22) of this Act.

Section 33. **Limitation as to Suit of Sub-Contractors to Enforce Lien.)** Petition shall be filed or suit commenced to enforce the lien created by Sections twenty-one (21) and twenty-two (22) of this Act within four months after the time of the final payment is due the sub-contractor, laborer or party furnishing material.

Section 34. **General Provisions—Suit to be Commenced or Answer Filed by Lien Claimants, and Within Thirty (30) Days on Demand of Owner, Liener or Interested Party.)** Upon written demand of the owner, liener or any person interested in the real estate, or their agent or attorney, served on the person claiming the lien, or his agent or attorney, requiring suit to be commenced to enforce the lien, or answer to be filed in a pending suit, suit shall be commenced, or answer filed within thirty days thereafter, or the lien shall be commenced or answer filed within thirty days thereafter, or the lien forfeited, and same released if a claim for a lien has been filed with the clerk of the Circuit Court.

Section 35. **Neglect to Satisfy Lien Paid or to Release Where Not Sued on Time—Penalty.)** Whenever a claim for lien has been filed with the clerk of the Circuit Court, either by the contractor or sub-contractor, and is afterward paid with cost of filing same, or where there is a failure to institute suit to enforce the same after demand, as provided in the preceding section, within the time by this Act limited, the person filing the same or someone by him duly authorized in writing so to do shall acknowledge satisfaction or release thereof, in the proper book in such office, in writing on written demand of the owner, and on neglect to do so for ten days after such written demand, he shall forfeit to the owner the sum of twenty-five (25) dollars, which may be recovered in an action of debt before a justice of the peace.

Section 36. **Penalty for Wrongful Sale, Use or Removal of Materials.)** Any owner, contractor, sub-contractor or other person who shall purchase material on credit and represent at the time of purchase that the same are to be used in a designated building or buildings, or other improvement, and shall thereafter sell, use or cause to be used, the said materials in the construction of, or remove the same to any building or improvement other than that designated or dispose of the same for any purpose, without the written consent of the person of whom the materials were purchased, with intent to defraud such person, shall be deemed guilty of a misdemeanor and, on conviction, shall be punished by a fine not exceeding five hundred dollars ($500), or confined in the county jail not exceeding one year, or both so fined and imprisoned.

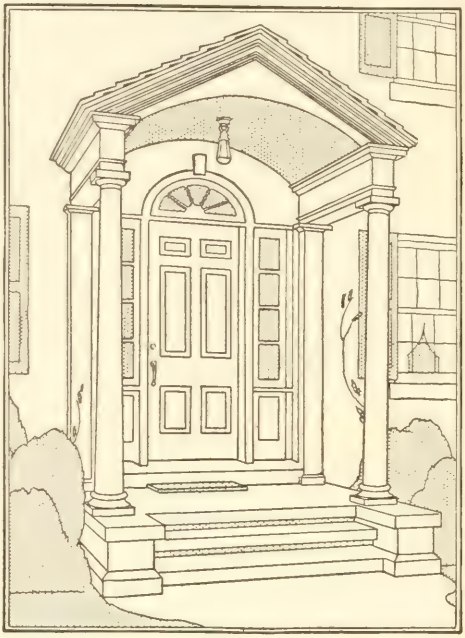
Section 37. **Liens Against Boats, Barges and Water Craft.)** Any architect, contractor, sub-contractor, materialman or other person furnishing services, labor or material for the purpose of or in constructing, building, altering, repairing or ornamenting a boat, barge or other water craft, shall have a lien on such boat, barge or other water craft for the value of such services, labor or material in the same manner as in this Act provided for services, labor or material furnished by such parties for the purpose of building, altering, repairing or ornamenting a house or other building. And such lien may be established and enforced in the same manner as liens are established and enforced under this Act, and the parties shall be held to the same obligations, duties and liabilities as in case of a contract for building, altering, repairing or ornamenting a house or other building.

Section 38. **Circuit Court Clerk's Duties with Regard to Claims Filed—Abstract Fee.)** When claims for liens are filed pursuant to the provisions of Sections seven (7) and twenty-five (25), the clerk of the Circuit Court shall endorse thereon the date of filing, and make an abstract thereof, in a book kept for that purpose and properly indexed, containing the name of the person filing the lien, the amount of the lien, the date of filing, the name of the person against whom the lien is filed, and a description of the property charged with the lien, for which the person filing the lien shall pay one dollar ($1.00) to the Clerk.

Section 39. This Act is and shall be liberally construed as a remedial Act.

Section 40. An Act entitled, "An Act to revise the law in relation to mechanic's liens," approved and in force June 26, 1895, and all other Acts and parts of Acts inconsistent with this Act are hereby repealed: Provided, that this section shall not be construed as to affect any rights existing or actions pending at the time this Act shall take effect.

Hurd's Rev. St. 1916, p. 1655, chap. 82, sec. 15.



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BUILDING ORDINANCE
OF THE CITY OF CHICAGO

Revised Code of 1922

Comprising Chapter XVII, Sections 396 to 945 of the Chicago Code of 1922. With Amendments up to and including July 22, 1925.

The Building Code of the City of Chicago has been radically revised and many of the Special Ordinances that were passed within a period of twelve years and known as Special Ordinances and sections that had to do with the Fire and Health Departments were eliminated and placed in those departments. This new arrangement thus afforded an opportunity of changing the plan of publication, which we believe will prove a great benefit to the users of the Handbook.

Particular attention is directed to the numerous Special Rulings of the Department of Buildings on certain disputed sections in the Building Ordinance and which follow at the end thereof.

To eliminate obscurity in the meaning of the ordinances, a plan of illustrating the difficult passages by means of illustrative diagrams has been adopted with the approval of the Commissioner of Buildings. All diagrams used, have been submitted to the commissioner to determine their correctness of interpretation and are published with his sanction.

The illustrative drawings and diagrams with their description and arrangement are copyrighted and the system protected and all rights are reserved in this as well as other cities of the United States.

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CHAPTER XVII.

Buildings.

ARTICLE I.

396. **Department of Buildings Established —Officers.)** There is hereby established an executive department of the municipal government of the City of Chicago which shall be known as the Department of Buildings and which shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, a Building Inspector in charge, an Elevator Inspector in charge, a Secretary of the Department of Buildings and such number of assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors, and such other officers, assistants and employees as may be from time to time provided for in the annual appropriation ordinance.

397. **Building Commissioner—Appointment Bond.)** There is hereby created the office of Commissioner of Buildings. He shall be the head of said department of buildings and shall be an experienced architect, or a civil, structural or architectural engineer or a building contractor or an efficient building mechanic and shall have been engaged as an architect or a civil, structural or architectural engineer or building contractor or building mechanic for a period of not less than ten ears prior to his appointment. During his term of office as Commissioner of Buildings he shall not be engaged in any other business.

He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

398. **Other Offices.)** There are hereby created the offices of Deputy Commissioner of Buildings, Engineer in Charge, Building Inspector in charge, Elevator Inspector in charge, Fire Escape Inspector in charge, Secretary to the Commissioner of Buildings, Assistant Engineer in charge and the officers of such number of Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors and Fire Escape Inspectors as may from time to time be provided for in the annual appropriation ordinance. The incumbents of these offices shall be known and designated by their respective titles as herein set forth.

399. **Appointment of Subordinates—Duties of Commissioner.)** (a) The Commissioner of Buildings shall have the management and control of all matters and things pertaining to the department of buildings, and shall appoint, and may remove according to law, all subordinate officers and assistants in his department. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

(b) The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings while in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

(c) It shall be the duty of said commissioner and his assistants to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety oi buildings.

400. **Personal Liability.)** In all cases where any action is taken by the Commissioner of Buildings to enforce the provisions of any of the sections contained in this chapter or to enforce the provisions of any of the building ordinances of the city now or at any time hereafter in force, whether such action is taken in pursuance of the

express provisions of such sections or ordinances or in a case where discretionary power is given by the ordinances of said city to the Commissioner of Buildings, such acts shall be done in the name of and on behalf of the City of Chicago, and the said Commissioner of Buildings in so acting for the city shall not render himself liable personally, and he is hereby relieved from all personal liability, for any damage that may accrue to persons or property as a result of any such act permitted in good faith in the discharge of his duties, and any suit brought against the said Commissioner of Buildings by reason thereof shall be defended by the Department of Law of said city until the final termination of the proceedings therein.

401. **Power to Pass On Ordinances.)** The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications and limitations contained therein.

402. **Inspection of Buildings or Structures Where Complaint is Made—Duty of Commissioner—Unlawful to Continue Use of Buildings Not in Compliance with Ordinances.)** It shall be the duty of the Commissioner of Buildings where any citizen represents that any building or structure or part thereof is in an unsafe or dangerous condition, or that the stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic or accident, or that the stairways, exits and fire escapes of any building or structure in the city do not comply with the requirements of this chapter to make an examination of such building or structure, and if such representation is found to be true the said Commissioner shall give notice in writing to the owner, occupant, lessee or person in possession, charge or control of such building or structure to make such changes, alterations or repairs as safety or the ordinances of the city may require. Upon failure of parties so notified to comply with the requirements of said notice the matter shall be placed in the Department of Law of the City of Chicago for prosecution.

It shall be unlawful to continue the use of such buildings until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this Chapter, shall have been made.

403. **Buildings Found in Unsafe Condition—Notice to Owner—Authority of Commissioner.)** (a) Whenever the Commissioner of Buildings shall find any building, or structure or part thereof in the city in such an unsafe condition as to endanger life, but in such condition that by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty, to forthwith notify, in writing, the owner, agent or person in possession, charge or control of such building or structure or part thereof, to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition; such notice shall state briefly the nature of the work required to be done and shall specify the time within which the work required to be done shall be completed by the person, firm or corporation notified, which shall be fixed by said Commissioner of Buildings, upon taking into consideration the condition of such building or structure or part thereof, and the danger to life or property which may result from its unsafe condition.

(b) Whenever such Commissioner of Buildings shall be unable to find the owner of such building, structure or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall address, stamp and mail such notice to such person or persons at their last known address, and in addition thereto shall place or cause to be placed the notice herein provided for upon such building at or near its principal entrance, and shall also post or cause to be posted in a conspicuous place at each entrance to such building, in large letters, a notice as follows:

"THIS BUILDING IS IN A DANGEROUS CONDITION AND HAS BEEN CONDEMNED BY THE COMMISSIONER OF BUILDINGS."

(c) It shall be unlawful for any person, firm or corporation to remove said notice or notices without written permission from the Commissioner of Buildings.

(d) If at the expiration of the time specified in such notice for the completion of the work required to be done by the terms of such notice, in order to render the building or structure safe, said notice shall not have been complied with, and said building or structure is in such an unsafe condition as to endanger life or property, it shall be the duty of the Commissioner of Buildings to proceed forthwith to tear down or destroy that part of said building or structure that is in such unsafe condition as to endanger life or property, and in cases where an unsafe building or structure cannot be repaired or rendered safe by the application of precautionary measures, such building or structure, or the dangerous parts thereof, shall be torn down by said Commissioner of Buildings or by his order and the expense of tearing down any part of such building or structure shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the said commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control thereof the cost of doing such work, by legal proceedings prosecuted by the Law Department.

(e) If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said commissioner within the time specified in such notice, in such case, at the expiration of such time it shall be unlawful for any person, firm or corporation to occupy or use said building or structure, or any part thereof, until said building or structure or part thereof is placed in a safe condition; and in case where a building or structure, or part thereof, is in a dangerous or unsafe condition and has not been placed in a safe condition within the time specified in the notice of the Commissioner of Buildings, such building or structure, or such part thereof, shall be forthwith vacated, and it shall be unlawful for any person or persons to enter same except for the purpose of making repairs required by the Commissioner of Buildings and the ordinances of the City of Chicago.

404. **Building or Part of Building Constructed or Being Constructed in Violation of Chapter—Authority of Commissioner to Tear Down.)** (a) Whenever it shall be found that any building or structure, or part thereof, is being, or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is

being, constructed or erected contrary to the provisions of this chapter and shall specify briefly in such notice in what manner the provisions of this chapter or any of them, have been violated, and shall require the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

(b) If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building of structure is being erected, in legal proceedings prosecuted by the Department of Law.

405. **May Direct Fire Department to Remove.)** The Commissioner of Buildings shall have authority to direct the Fire Commissioner to tear down any defective or dangerous wall or structure or any building or structure or part thereof which may be constructed in violation of the terms of this chapter, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, directing him or them to tear down or remove any defective wall, building or structure, or any part thereof, which is in a dangerous condition, which has been, or is being, constructed or maintained in violation of the terms of this chapter. In case of the destruction or partial destruction of buildings by fire, decay or otherwise, when any department of the city government, pursuant to the ordinances of the city, shall make an outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of such building or buildings, or structure, or for the preservation of life of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or its or their agent or agents, and it shall be the duty of said Commissioner of Buildings to refuse to issue a permit for the construction, re-construction, alteration or repair of any building or buildings or structure by any such owner or owners, lessee, occupant, agent or person in possession, charge or control thereof until such outlay or expenditure shall be repaid to the city by the owner, lessee, occupant, agent or person in possession, charge or control of such building or buildings thus totally or partially destroyed in the manner aforesaid. Said commissioner shall also proceed forthwith to collect the amount of such bill from such owner or owners, by legal proceedings prosecuted by the Department of Law.

406. **May Stop Construction and Wrecking of Buildings.)** (a) Said commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner, or with defective material, or in violation of any ordinance, and to order, in writing or by parol, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

(b) And the said commissioner shall have power to stop the wrecking or tearing down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said commissioner, it shall not be resumed until said commissioner shall be satisfied that adequate precautions will be taken for the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

407. **Arbitration—Appeal from Decision.)** (a) In all cases where discretionary power is given to the Commissioner of Buildings to estimate damage to buildings, as also in questions relating to the security of any building or buildings or structures, or part thereof, and in all other cases where discretionary powers are given by ordinance to the Commissioner of Buildings, any party or parties believing themselves injured or wronged by the decision of the Commissioner of Buildings may before instituting any suit, make an appeal for arbitration as follows, to-wit:

(b) Any person wishing to make an appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to any arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

(c) The Commissioner of Buildings shall thereupon inform the appellant of the cost of such arbitration and such appellant shall, within twenty-four hours from the receipt of such information, deposit with the Commissioner of Buildings the sum of money requested for defraying the expense of the same, which sum shall be fixed in each case by said commissioner in proportion to the time it will take and the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city and the two arbitrators thus chosen shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation and consideration of the matter in question, be final and binding upon the appellant as well as the city unless an appeal is taken therefrom, as provided in case of an appeal under a statutory arbitration, within five days thereafter.

408. **Arbitrators to Take Oath—Power to Examine Witnesses.)** The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath by the City Clerk, to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing, both to the Commissioner of Buildings and to the appellant. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report and shall be in full of all

costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him and the entire cost of such arbitration shall be paid by the city.

409. **In Urgent Cases—Commissioner's Power Final.)** Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case which is so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

410. **Duty of Police to Assist Commissioner in Enforcing Provisions of this Chapter.)** Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said department, when called upon by said commissioner, to act according to the instructions of, and to perform such duties as may be required by said commissioner in order to enforce or put into effect the provisions of this chapter.

411. **Certificates—Notices—Register.)** (a) The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from the Department of Buildings and shall keep a record of the same, and shall issue or cause to be issued all permits authorized by this chapter.

(b) He shall also keep a proper record of all transactions and operations of the department and such record shall be at all times open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Commissioner and members of the City Council.

412. **Must Keep Account of Fees Paid—Annual Reports and Estimates.)** (a) Said commissioner shall keep in proper books for that purpose an accurate account of all fees charged, giving the name of person to whom same is charged, date on which said charge is made, and the amount of each such fee.

(b) He shall also, annually, on or before the first day of March in each year prepare and present to the City Council a report showing the receipts and expenditures and entire work of the Department of Buildings during the previous fiscal year and he shall on or before November first of each year prepare and submit to the Comptroller an estimate of the whole cost and expense of providing for and maintaining his office during the ensuing fiscal year.

413. **Examination and Approval of Plans —Record of Inspections and Complaints.)** The Commissioner of Buildings and his assistants shall pass upon all questions relating to the strength and durability of buildings or structures; shall examine and approve all plans before a permit is issued for the construction of any building or structure. The Commissioner of Buildings shall cause to be kept a complete record showing the location and character of every building or other structure for which a permit is issued and shall cause to be filed every report of inspection made on such building, which reports shall bear the signatures of the inspectors making such inspections. He shall cause a record to be kept of all complaints of violations of the building laws and shall cause all such complaints to be investigated.

414. **Deputy Commissioner of Buildings—** There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this office shall be either a civil, structural or architectural engineer or an architect, an experienced building contractor or an efficient building mechanic with at least five years' experience and training.

415. **Deputy Commissioner of Buildings—Duties.)** (a) The Deputy Commissioner of Buildings shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office and while so acting shall discharge all the duties and possess all the powers imposed upon or vested in the Commissioner of Buildings.

(b) The deputy commissioner of buildings shall, under the direction of the Commissioner of Buildings, have general control of all matters and things pertaining to the work of the Department of Buildings and shall perform such other duties as may be required of him by the Commissioner of Buildings.

416. **Engineering Staff.)** The Commissioner of Buildings shall appoint according to law at least four Architectural Engineers, and such other engineers and assistants as the City Council may by ordinance provide, for service on the engineering staff of the Department of Buildings. Every person certified to fill the position of Architectural Engineer shall be a civil, structural or architectural engineer of at least five years' training and experience.

417. **Architectural Engineers — Duties.)** The Arcitectural Engineers shall, under the direction of the Commissioner of Buildings, examine all plans submitted for the purpose of obtaining a permit. They shall also examine and verify the figures on all floor load placards before such placards are approved for posting. They shall, in addition thereto, perform such other duties as may be required of them by the Commissioner of Buildings.

418. **Building Inspector in Charge — Duties.)** (a) There is hereby created the office of Building Inspector in charge of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, architectural or fire protection engineer, or an architect, or building superintendent or a building mechanic, with at least five years' experience in general building construction.

(b) In the absence of the Commissioner of Buildings and the Deputy Commissioner of Buildings from their offices the Building Inspector in Charge shall act as Commissioner of Buildings, and while so acting he shall discharge all of the duties and possess all of the powers imposed upon or vested in the Commissioner of Buildings.

(c) He shall have immediate charge of the periodical inspection of buildings and of the inspection of buildings and structures being erected, enlarged, altered or repaired, excepting only such inspection as is expressly assigned to the elevator or fire-escape inspectors or is by law assigned to some other department of the city government.

419. **Assistant Building Inspectors In Charge.)** (a) The Commissioner of Buildings shall appoint, according to law, at least four Assistant Building Inspectors in Charge.

(b) Every person certified to fill the position of Assistant Building Inspector in Charge shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Assistant Building Inspectors in Charge shall have immediate charge of the several

districts assigned to them by the Commissioner of Buildings and shall perform such other duties as the Commissioner of Buildings shall require them.

420. **Building Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Building Inspectors as may be necessary.

(b) Every person certified to fill the position of Building Inspector shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Building Inspectors shall, under the direction of the Building Inspector in Charge, examine all buildings and structures in the course of erection, enlargement, alteration, repair or removal, as often as is required for efficient supervision, and shall make such periodical examinations of existing structures as shall be assigned to them. They shall examine all buildings, structures and walls reported to be in dangerous condition. They shall examine all buildings and other structures for the enlarging, altering, raising or removing of which, application for permit shall be made.

(c) Every building inspector shall make written reports daily to the Commissioner of Buildings as to the condition in which he found each building examined and as to violations, if any, of the ordinances which the Commissioner of Buildings is required to enforce, together with the street and number of the premises where such violations, if any, were found, the names of the owner, agent, lessee and occupant thereof, and of the architect and the contractor engaged in and about the work in question. The Building Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

421. **Elevator Inspector in Charge.)** (a) There is hereby created the office of Elevator Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Elevator Inspector in Charge, shall be a graduate in engineering from a recognized technical school, shall be versed in the essentials of both mechanical and electrical engineering and shall have had at least five years experience in shop or construction work.

422. **Duties of Elevator Inspector in Charge.)** The Elevator Inspector in Charge shall examine all plans for the installation of elevators and for the installation of mechanical devices and apparatus in theaters, amusement parks and the like, and, no such elevator, mechanical device or apparatus shall be installed or operated without the approval of the Elevator Inspector in Charge. The Elevator Inspector in Charge shall cause such inspection to be made of all new installations, as may be necessary to insure the carrying out of the approved plans and shall cause such periodic inspection to be made of existing installations of such mechanisms, devices and apparatus, as may be required by the Commissioner of Buildings, and shall perform such other duties as may be required of him by the Commissioner of Buildings.

423. **Elevator Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Elevator Inspectors as may be necessary.

(b) Every person certified to fill the position of Elevator Inspector shall be a mechanical engineer, machinist or elevator builder, and shall be well grounded in the rudiments of mechanical and electrical engineering.

424. **Duties of Elevator Inspectors.)** The Elevator Inspectors shall inspect all elevators and such other mechanisms, devices and apparatus as shall be assigned to them by the Elevator Inspector in Charge, both existing and in process of being erected or installed, together with all the equipment and enclosures thereof. They shall make written reports daily to the Commissioner of Buildings as to the condition in which they find the elevators, equipment, enclosures, mechanisms, devices and apparatus, inspected by them, and of any violations of the requirements of this Chapter pertaining to such matters, together with the street and number of the premises where such violations, if any, occur, the names of the owner, agent, lessee and occupant thereof, and of the architect and contractor engaged in or about the construction and installation of such elevators, equipment, enclosures, mechanisms, devices or apparatus. They shall perform such other duties as may be required of them by the Commissioner of Buildings.

425. **Secretary—Duties.)** (a) There is hereby created the office of Secretary of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law.

(b) The Secretary to the Commissioner of Buildings shall, under the supervision and direction of the Commissioner of Buildings, preserve and keep all books, records and papers belonging to the office of the Department of Buildings or which are required by law to be filed therein. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

426. **Clerical Assistants.)** The Commissioner of Buildings shall appoint according to law, such clerical assistants, stenographers and messengers and other employees as may be provided for by the city council as may be necessary; and they shall perform such duties as may be required of them by the Commissioner of Buildings.

427. **Bonds.)** The deputy commissioner of buildings, the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge and the architectural engineers shall, before entering upon the duties of their offices or positions, each execute a bond running to the city of Chicago, conditioned for the faithful performance of their duties, with such sureties as the city council shall approve in the following sums: the deputy commissioner of buildings, ten thousand dollars; the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge, and the architectural engineers, five thousand dollars each.

428. **Employees Not to Engage in Another Business.)** Every employee in the Department of Buildings shall devote his entire time to such employment and shall not be engaged in any other business or vocation.

429. **Power of Entry.)** The Commissioner of Buildings and his Assistants are empowered to enter any building or structure or premises, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed and maintained in accordance with the provisions of this chapter and it shall be unlawful to exclude them from any such building, structure or premises.

ARTICLE II.

Permits, Plans and Fees

430. **Permits—When Required—Limitations of Time For.)** Before proceeding with the erection, enlargement, alteration, repair or removal of any building or structure in the city, a permit for such erection, enlargement, alteration, repair or removal

shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall have first been obtained from the Commissioner of Buildings. And if after such permit shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time, then such permit shall be void, and no operations thereunder shall be begun or completed until an extended permit shall be taken out by the owner or his agent, and a fee of twenty-five per cent. of the original cost of permit shall be charged for such extended permit, provided, however, that in no case shall a permit be issued or renewed for a less fee than two dollars.

431. **Permits—Application For.** Application for building permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans in conformity with the provisions of this chapter which have been examined and approved by the Commissioner of Buildings and his assistants, as hereinbefore provided for, shall be filed with the Commissioner of Buildings. He shall then issue a permit, and shall file such application, and shall apply to such plans a final official stamp, stating that the drawings to which the same has been applied comply with the terms of this chapter. The plans so stamped shall then be returned to such applicant. True copies of so much of such plans as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings, and shall remain on file in his office for a period of six months after the occupation of such building, after which such drawings shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him, upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than six month after the occupation of the building to which they relate.

432. **Approval of Plans by Other Departments.)** All plans and drawings for the construction or alteration of any building or other structure for which building permits are required shall, before such permits are issued, be presented to the Commissioner of Health for examination and approval as to the proposed plan for the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. They shall also be presented to the Chief Fire Prevention Engineer for examination and approval with regard to such ordinances as are within the duty of such office to enforce. They shall also be presented to the Boiler Inspector and the Smoke Inspector in all cases where permits from these departments are required to be procured by the ordinances of the City.

433. **Issuance of Permits.)** All plans and drawings for the construction or alteration of any building or other structure for which a building permit is required may, at the option of the applicant for a building permit and by payment of a fee of one dollar for each plan, be filed in the office of the Commissioner of Buildings, and a receipt or check will be given for said plans which must be presented for the return of same after they have been examined and passed upon. The Commissioner of Buildings shall appoint a clerk with such necessary assistants whose duty it shall be, under the direction of the Commissioner of Buildings, to receive, take charge of and return all plans and drawings filed as aforesaid. Every plan or drawing so filed in the office of the Commissioner of Buildings shall be forwarded by him successively to the Department of Smoke Inspection, the Department of Boiler Inspection, the Department of Public Works, the Bureau of Fire Prevention and the Sanitary Bureau, and there submitted to the proper officials of these respective

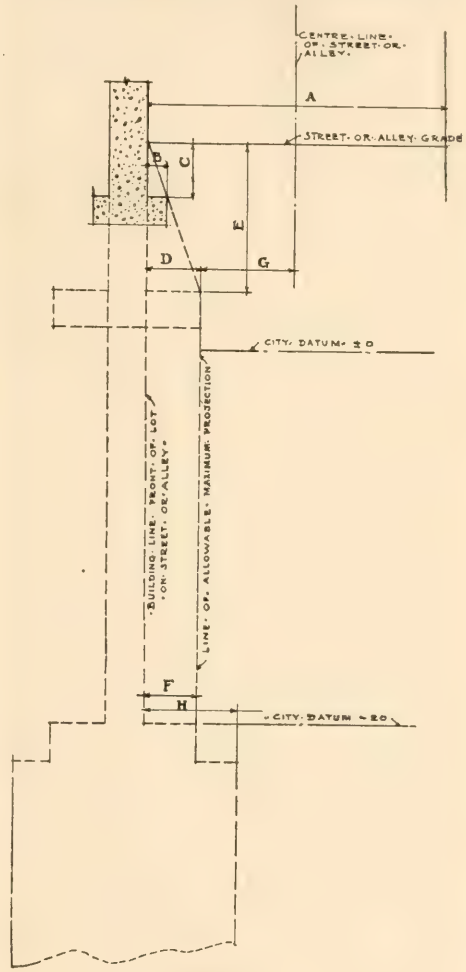

Fig. 1.

FOUNDATIONS.
See Section 436.

(A) Width of street.
Provision made for 16′ 0″ or over.
Provision made for less than 16′ 0″.

(B) Allowable projection.
A ratio of 4½″ to every foot of (C).

(C) Depth of foundation below inside sidewalk grade or alley grade—See (B).

(D) Maximum allowable projection at point (E) 8′ 0″ below said sidewalk or alley grade = 3′ 0″.

(E) Point at depth of formation (8′ 0″) below sidewalk or alley grade where maximum projection begins. See (D).

(F) Allowable maximum projection from (E) to 20′ 0″ below plus or minus 0 city datum = 3′ 0″

(G) For streets, alleys, etc., less than 16′ 0″ in width. Foundations may not be built nearer than (G) 5′ 0″ to middle line of streets or alleys, etc.

(H) Allowable projection below 20′ 0″ city datum to be determined so far as in the opinion of the Commissioner of Buildings is necessary.

departments and bureaus for examination and approval, and after said plans have been examined and passed upon, the Commissioner of Buildings shall cause said plans or drawings to be returned to his office where they shall be taken up for examination and approval by the Commissioner of Buildings. At the proper time notice shall be given by the Commissioner of Buildings to the applicant that his plans have been examined and are ready to be returned to him, and if such plans have been approved as submitted by the various departments and bureaus as aforesaid, the Commissioner of Buildings then shall, according to ordinance, issue a permit for the construction or erection of such building or structure.

434. **Encroachment on Public Highway.)** The Commissioner of Buildings shall not issue any permit authorizing the construction, erection repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago, nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the City Government, pursuant to an ordinance, specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure or any of its appurtenances, or attachments thereto, extend over any part of any public highway or other public ground than hereinafter provided for shall, previous to being submitted to the Commissioner of Buildings, be submitted to the Commissioner of Public Works and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the Commissioner of Public Works must accompany plans when same are presented to the Commissioner of Buildings.

435. **Cornices and Belt Courses.)** The Commissioner of Buildings may issue permits for the horizontal cornices and belt courses so called to be constructed on buildings as follows:

Where all parts of a cornice of any building or structure are more than twelve feet above the inside grade of the sidewalk, and in cases where the sidewalk grade varies, are more than twelve feet above the average or mean inside grade of the sidewalk and where such cornice extends in whole or in part along the street frontage, of a building, and where the return of such cornice if any along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street or alley a distance of twenty-four inches. For each additional one foot in height such cornice is placed above the height of twelve feet as aforesaid up to the limits of height fixed by ordinances for the particular building of which such cornice is a part, such cornice may project into the street or alley an additional one-quarter inch, until the total projection has reached the maximum of four feet six inches where the width of the street is less than sixty-six feet and to a maximum of five feet where the width of the street is sixty-six feet or more.

Horizontal belt courses, water tables and other horizontal architectural features, which do not add floor area to a building or structure and which extend in whole or in part along the street frontage of a building with a return if any around an alley wall not longer than a distance equal to the width of the alley, and where all parts of such horizontal belt courses, water tables and other horizontal architectural features are more than twelve feet above the inside grade of the sidewalk, may project into the street or alley a distance not to exceed eighteen inches.

436. **Encroaching Foundations.)** The Commissioner of Buildings may issue permits for buildings for which it is contemplated that there shall be projections of the foundation, or a part or parts thereof, into a public street, a public alley or a public thoroughfare under the following conditions: Where such street, alley or thoroughfare is sixteen (16) feet or more in width such foundations shall have no projection at the sidewalk or alley grade, but may project at the ratio of four and one-half (4½) inches to one (1) foot for each one (1) foot of depth such foundation may extend below the sidewalk or alley grade to a maximum projection of thirty-six (36) inches at a depth eight (8) feet below said sidewalk or alley grade, and such foundations, or such part or parts thereof, which are higher than a point twenty (20) feet below city datum and are lower than a point eight (8) feet below the sidewalk or alley grade, may project into such street, alley or thoroughfare for a distance not to exceed thirty-six (36) inches for such part of their extent as is included between a point eight (8) feet below the said sidewalk or alley grade and a point twenty (20) feet below said city datum, and, where said street, alley or thoroughfare is less than sixteen (16) feet in width, foundations, or any part or parts thereof, may project into such street, alley or thoroughfare at a ratio of four and one-half (4½) inches of projection to one (1) foot of depth, but no foundation, or part or parts thereof, shall be built nearer than five (5) feet to the middle line of such street, alley or thoroughfare. No foundation, or any part or parts thereof, shall project into a public street, a public alley or a public thoroughfare in such manner as to add area to the superstructure of any building or structure.

The construction of caisson and other types of foundations, part or parts of which may extend to a greater depth than twenty (20) feet below city datum, shall conform to the requirements of this section as hereinbefore contained in such part or parts as are higher than twenty (20) feet below city datum and lower than eight (8) feet below the sidewalk or alley grade and in such part or parts as are higher than eight (8) feet below the sidewalk or alley grade, but such part or parts of such last mentioned foundations as are constructed lower than twenty (20) feet below city datum may project into a public street, a public alley or a public thoroughfare so far as, in the opinion of the Commissioner of Buildings, is necessary for the stability of the building or structure of which they are a part.

It is expressly made a condition in the issuance of any permit for the construction of a building or structure whose foundations, or any part or parts thereof, project into a public street, a public alley or a public thoroughfare at any point higher than twenty (20) feet below city datum that if during the construction of or after the completion of such structure or building the said foundation or any part or parts thereof, shall project in such a manner as to interfere with or be an obstruction to the building of, maintaining, conducting or

operating any public utility now or hereafter to be constructed, or any part or parts of any construction in connection therewith, that such projecting foundations, projecting part or projecting parts thereof, shall be subject to removal upon notice from the Commissioner of Public Works so to remove them. Such notice shall be in writing and shall allow such length of time as said Commissioner of Public Works shall deem a reasonable time for the purpose of making the changes required thereunder, but the owner or owners of the said building or structure shall proceed at once upon receipt of said notice to remove all projecting part or parts of such foundations without any expense, loss or damage accruing to the City of Chicago. Upon failure of such owner or owners to comply with said notice by beginning the work required thereunder within thirty (30) days after the receipt of such notice or upon failure to complete same within such reasonable time thereafter as the Commissioner of Public Works shall deem sufficient, the Commissioner of Public Works may proceed at once to remove such projecting part or parts of such foundations and the City of Chicago may recover the cost and expense of such removal, unless otherwise reimbursed, by an action at law against the owner or owners, lessee or lessees of said promises.

437. **Additional Plans Showing Projections —Structure with Foundation Below Minus 40 City Datum.)** In addition to the general plan of the building or structure as required in other sections of this ordinance, a detailed plan drawn to a large scale of any proposed cornice or any projection contemplated in the two preceding sections shall be submitted to the Commissioner of Buildings for his examination and approval.

Whenever application is made for a permit to erect any building or structure, the foundations of which are designed to extend to an elevation of minus 40 Chicago datum, the plans of said building or structure shall be submitted to the City Engineer and his approval secured before a permit is issued for the erection of such building or structure by the Commissioner of Buildings; provided, however, that this requirement shall only apply within the district bounded as follows: starting at the intersection of the center line of east 12th street produced and the shore of Lake Michigan, thence west along the center line of east and west 12th street to the intersection of the center line of South Halsted street, thence north along the center line of South and North Halsted street to the intersection of the center line of West Chicago avenue, thence east along the center line of West and East Chicago avenue and East Chicago avenue produced to the shore of Lake Michigan, then southeasterly along the shore of Lake Michigan to the place of beginning; and, provided, further, that this restricted provision shall apply to all buildings or structures designed to be erected at any location within the city when the nearest point on any of said proposed buildings or structures is within two hundred feet of the shore line of Lake Michigan, the Chicago River or any of its branches, the Drainage Canal, Lake Calumet or the Calumet River.

438. **Plans to be Kept on Work.)** In all cases the approved plan, together with building permits, must be kept on the job while the work is in progress.

439. **Plans—Essentials of.)** All plans and drawings for buildings or for structures other than buildings shall be presented to the Commissioner of Buildings for his approval, and each set of plans presented shall be approved by the Commissioner of Buildings before a permit will be granted. All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the lot lines and the entire sewerage and drain pipes and the location of all plumbing fixtures within such building or structure. No permit shall be granted or plans approved unless such plans are signed and sealed either by an architect licensed to practice architecture under "The Illinois Architectural Act," or by a structural engineer licensed to practice structural engineering under "The Illinois Structural Engineering Act."

440. **Plans—Alterations Upon Stamped Plans Not Permitted—Certain Alterations Excepted.)** It shall be unlawful to erase, alter or modify any lines, figures, or coloring contained upon such drawings so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, or drawing, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made; but alterations in buildings which do not involve any change in their structural parts or of their stair ways, elevators, fire-escapes or other means of communication, or ingress or egress, or in lighting or ventilation and that are not in violation of any of the provisions of this chapter, may be made without the permission of the Commissioner of Buildings.

441. **Deposit With Water Department—How Made—Indemnity Bonds—Fees for Water Used.)** (a) Before the Commissioner of Buildings issues a permit as provided herein, he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building in accordance with the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts and to the city and to any person in consequence, or by reason of, the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

(b) The fees to be paid for water used in connection with the erection of buildings shall be as follows, to-wit:

At the rate of five cents for every one thousand bricks, wall measure, used in connection therewith.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in connection therewith.

442. **Amount of Permit Fees.)** (a) The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, two dollars; for open shelter sheds, at the rate of two dollars for each one thousand cubic feet or fractional part thereof; for all buildings or other

structures, other than sheds and open shelter sheds, as hereinafter described, the fee for the permit shall be at the rate of twenty cents for every one thousand cubic feet or fractional part thereof for buildings containing not to exceed two hundred thousand cubic feet of volume. For buildings exceeding two hundred thousand cubic feet in volume twenty cents per cubic feet for the first two hundred thousand cubic feet and forty cents per one thousand cubic feet for each additional one thousand cubic feet of volume or fractional part, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof, and to include all bay windows and other projections; but in no case shall any permit be issued for a less fee than two dollars, except that a fee of two dollars shall be charged for recovering or recoating the roof of any building.

(b) The fee to be charged for permits issued for alterations and repairs in or to any building or other structure shall be based on the cost of such alterations and repairs and shall be at the rate of two dollars for the first one thousand dollars, or part thereof, and one dollar additional for each one thousand dollars or part thereof to be expended therefor. The fee for permit to raise any building other than a frame building shall be for raising, shoring up, underpinning or moving any building other than a frame building ten cents per one thousand cubic feet of volume or fractional part thereof: Provided, however, that in no case shall a permit be issued for a less fee than five dollars.

(c) In addition to the above permit fees for buildings, permit and inspection fee shall be charged as follows:

For erection of fire-escape, four dollars minimum to include fire-escapes up to four stories in height; and fifty cents additional for each story above four stories in height;

For installation or alteration of elevator, five dollars;

For semi-annual inspection of elevator, four dollars;

For erection of billboards or signboards, five dollars; for every twenty-five lineal feet or fractional part thereof;

For erection of illuminated and other roof signs under Section 919 of this chapter, fifty dollars for the first five hundred square feet of superficial area or fractional part thereof and five cents for each additional square foot area;

For annual inspection of billboard or signboard, one dollar for every twenty-five lineal feet of billboard or signboard or fractional part thereof;

For annual inspection of illuminated and other roof signs under Section 919, fifty dollars for the first five hundred square feet or fractional part thereof, five cents additional for each additional square foot area;

For annual inspection of building required by Section 445 of this chapter, three dollars for each twenty-five thousand square feet or fractional part thereof;

For semi-annual inspection of iron or steel curtain, ten dollars;

For semi-annual inspection of asbestos curtain, five dollars;

For permit for tank on roof or tower in excess of four hundred gallon capacity, five dollars;

For permit for isolated chimneys or for chimneys extending over fifty feet above the roof of any building, five dollars;

443. **Permit for Wrecking Building—Bond.)** (a) Before proceeding with the wrecking or tearing down of any building or other structure more than one story in height, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part of such building or structure unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings, who shall issue such permit upon such application and the payment of the fee herein provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be five ($5.00) dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit, such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings and to such reasonable restrictions as he may impose in regard to elements of safety and health, and provided, further, that the work shall be kept sprinkled and sufficient scaffolding be provided to insure safety to human life, and to comply with the Provisions of the Act of the General Assembly, Passed June 3, 1907, in force July 1, 1907, Providing for the safety of workmen in and about the construction and removal of buildings.

(b) Before any permit is issued granting authority to wreck a building or structure for which such permit is required, the person, firm or corporation engaged in the work of wrecking same shall file with the City Clerk a bond with sureties to be approved by the City Comptroller to indemnify, keep and save harmless the City against any loss, cost, damage, expense, judgment or liability of any kind whatsoever which the City may suffer, or which may accrue against, be charged to or be recovered from said City, or any of its officials, from or by reason or on account of accidents to persons or property during any such wrecking operations, and from or by reason or on account of anything done under or by virtue of any permit granted for any such wrecking operations. Such bond in each case shall extend to and cover all such wrecking operations carried on through permits obtained thereunder by such person, firm or corporation during any fiscal year beginning January first and ending December thirty-first, and no permit shall be issued for any wrecking work except as hereinbefore otherwise provided during such fiscal year until such bond is filed. Said bond shall be in the penal sum of twenty thousand dollars for all wrecking operations on such buildings and other structures not more than three stories in height, and there shall be an additional bond filed in the penal sum of twenty thousand dollars or a bond in the penal sum of forty thousand dollars shall be filed in the first instance in case of wrecking operations on buildings and other structures four or more stories in height. Upon the filing of such bond or bonds the person, firm or corporation engaged in the work of wrecking such buildings and other structures may obtain permits for such wrecking operations as are authorized under the said bond or bonds as hereinabove provided for during the fiscal year in which the same is or are filed: Provided, that, in case of accident or casualty in the progress of any wrecking operations carried on under any permit so issued, or the happening of any circumstance which might in the opinion of the Commissioner of Buildings render such bond or bonds inadequate, the said Commissioner may, in his discretion, require such additional bond as he may deem necessary to fully protect the city from loss resulting from the issuance of such permits before he allows the work to proceed or before any additional permits are issued by him.

444. **Permit—Revocation of.)** If the work in, upon or about any building or structure shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the

building or wrecking operations in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building or wrecking operations unless such permit shall first have been re-instated or re-issued by the Commissioner of Buildings. Before a permit so revoked may be lawfully re-issued or re-instated, the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such building.

445. **Annual Inspection of Buildings—Revolving Doors—Stairways and Means of Egress—Inspection Fee.)** (a) The Commissioner of Buildings and his assistants shall make an annual inspection of all theaters and places of amusement, worship, instruction or entertainment, and also of all other buildings over two stories in height, except residences, and except buildings in which automobiles are housed, and except tenements three stories or less in height. It shall be the duty of every owner, agent, lessee or occupant of any such building as is referred to in this section and of the person in charge or control of same to permit the making of such annual inspection by the Commissioner of Buildings, or by a duly authorized Building Inspector, at any time upon demand being duly made.

(b) Whenever any such inspection shows the building to be in compliance with the requirements of this Chapter with respect to stairways, means of egress, and in all other respects, it shall be the duty of the Commissioner of Buildings to issue, or cause to be issued, a certificate setting forth the result of such inspection, containing the date thereof, and a statement to the effect that such building complies in all respects with the provisions of this Chapter, upon the payment of the inspection fee herein required.

(c) It shall be the joint and several duty of the owner, agent, lessee or occupant of the building so inspected and of each and every person in charge and control of the same to frame the said certificate and place it in a conspicuous place near the main entrance of such building.

(d) It shall be the joint and several duty of the owner, agent, lessee or occupant of every building described in this section to provide a typical floor plan of such building reproduced on a sheet eight by ten inches in size. Said plan shall be drawn on as large a scale as will be practicable on such sheet, and said sheet shall also state the street address of such building, and shall give the class of the building, the kind of construction used therein, the height and number of stories contained therein and the nature of the occupancy.

(e) It shall also be the joint and several duty of such owner, agent, lessee or occupant to deliver a copy of said sheet to the Commissioner of Buildings and to frame a copy of said sheet and place the same near the framed certificate hereinabove required.

(f) It shall also be the joint and several duty of the said owner, agent, lessee or occupant to substitute a new sheet for the sheet on file with the Commissioner of Buildings, and also the sheet framed as above required, whenever such changes or alterations are made in such building as will affect the substantial accuracy of the sheet previously furnished such Commissioner and framed as above required.

(g) Where the result of such inspection shall show that such building fails in any respect to comply with the requirements of this Chapter, it shall be the duty of the Commissioner of Buildings to notify the owner, agent, lessee or occupant of such building to this effect and to specify wherein such building fails to comply with the requirements of this chapter; and it shall thereupon become the joint and several duty of such owner, agent, lessee or occupant to proceed forthwith to make whatever changes or alterations may be necessary to make such building comply in all respects with the requirements of this chapter and to complete such changes and alterations within thirty days after the receipt of such notice.

(h) Upon making such annual inspection, it shall be the duty of the owner to pay to the City Collector an annual inspection fee for the same, amounting to three dollars for each 25,000 square feet of floor area, or fractional part thereof: Provided, however, that no charge for such annual inspection shall be made against religious, charitable or educational institutions.

(i) Every revolving door now in operation or which may hereafter be installed, together with all the equipment and mechanism therof shall be inspected semi-annually, under and by authority of the Commissioner of Buildings.

Whenever such inspection shows a revolving door to be in good working order and in compliance with the Ordinances of the City of Chicago pertaining to revolving doors and their use as exit doors, the Commissioner of Buildings shall issue, or cause to be issued, a certificate to that effect; and for each such inspection and certificate a fee of two dollars shall be charged. Provided, however, that revolving doors affording exit from ground floor premises used by one person, firm or corporation, shall be exempt from the semi-annual inspection and fee requirements of this paragraph, where such exit door has no connection with or affords no exit facilities to any other floor of the building or to any premises or space occupied or used by any other person, firm or corporation.

446. **Architect Must Certify That Plans Comply With the Building Ordinances.)** It shall be unlawful for any architect, or other person permitted under the laws of the state to make plans, to prepare or submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with the structural requirements of this chapter. It shall be the duty of the Commissioner of Buildings to require that all plans submitted to him for approval for any building or structure shall be accompanied by a certificate of such architect or such other person preparing such plans that the plans submitted comply with the structural requirements of this chapter.

447. **Constructing Buildings Contrary to Approved Plans—Permit Made Void by Deviation from Plans—Power to Stop Work.)**

(a) It shall be unlawful for any owner, agent or architect, or for any contractor or builder engaged in erecting, altering or repairing any building, to make any departure from the plans as approved by the Commissioner of Buildings of such nature that such departure involves any violation of the requirements of this chapter as to buildings of the class in which such building belongs, or to make any changes in plans or construction affecting means of egress, ventilation, natural lighting, or sanitary conditions without first obtaining the written consent of the Commissioner of Buildings and of the Commissioner of Health to such changes. Any such departure from the approved plans involving a violation of the requirements of this chapter or any such change in the plans or construction without the consent of the Commissioner of Buildings and the Commissioner of Health being obtained, as required herein, shall operate to annul the permit which has been issued for such work and shall render the same void.

(b) In case any work is done under a permit authorizing the erection, alteration

or repair of a building or structure, which work is contrary to the approved plans, the Commissioner of Buildings or the Commissioner of Health and their assistants shall have power to at once stop such work and to order all persons engaged therein to stop and desist therefrom. Such work shall not be resumed until satisfactory assurance has been given to the Commissioner of Buildings or the Commissioner of Health, as the case may be, that it will be done according to the approved plan or until said Commissioner of Buildings or Commissioner of Health has consented in writing to the changes made in such approved plans, and if such changes in the approved plan involve additional work a new permit or an extended permit shall be issued for which an additional fee shall be paid by the contractor doing such work.

(c) No contractor or builder shall begin any work on any building or structure for which a permit is required until such permit shall have been secured. In case any work is begun on the erection, alteration, repair or removal of any building or structure without a permit authorizing the same being issued therefor, the Commissioner of Buildings and his assistants shall have power to at once stop such work and to order any and all persons engaged therein to stop and desist therefrom until the proper permit is secured.

ARTICLE III.

Classification of Buildings.

448. **Buildings—Classification of.)** (a) All buildings other than sheds and shelter sheds as hereinafter described, now existing or hereafter erected, altered or enlarged, shall be classified as follows:

(b) **Class I.)** In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purposes of a barn, stable or a garage or for the housing or keeping of automobiles.

(c) **Class II.)** In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(d) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

(e) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(f) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

(g) **Class III.)** In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for not to exceed twenty persons or where not to exceed ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

(h) **Class IV.)** In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc, and Class IVd, as follows:

(i) In Class IVa shall be included every building used as a church or place of worship.

(j) In Class IVb shall be included every building having a parish hall, Lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(k) In Class IVc shall be included every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred persons, provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(l) In Class IVd shall be included every grand stand and every baseball athletic and amusement park.

(m) **Class V.)** In Class V shall be included every building which is used as a public theatre where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 persons and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than 600 persons although occasionally used for theatrical presentations, shall not be construed to be public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IVb, as defined in this section.

(n) **Class VI.)** In Class VI shall be included every tenement and apartment house or building or portion thereof which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(o) **Class VII.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

(p) **Class VIII.)** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

(q) **Class IX.)** In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

(r) Requirements with regard to buildings not within any of the above classes shall be determined by the Commissioner of Buildings subject to arbitration in the same manner as provided in Sections 407 and 408 of this chapter.

449. **Buildings Used for the Purposes of More Than One Class.)** Where any building is used for the purposes of two or more classes, as herein specified, and defined, such portion of any such building as is devoted

to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this chapter relating to such class, unless such construction shall, in the opinion of the Commissioner of Buildings, prove impracticable, or unless there would be a conflict between the provisions of this chapter relating to the construction of buildings, in either of which cases the construction requirements which relate to and govern the construction of buildings of the class requiring the best and safest form of construction shall govern the entire building; provided, however, that in any building exceeding twenty stories in height, where such building is used to house five or more self-propelled vehicles in addition to other uses, and not more than one-third of such building is so used for the housing of five or more self-propelled vehicles; and such building is throughout of fireproof construction and the portion of such building so used for the housing of five or more self-propelled vehicles is completely separated by fireproof walls and fireproof roof from the remainder of the building such portion of said building so used for the housing of five or more self-propelled vehicles shall comply with the requirements for class I buildings as set forth in this chapter, and the remainder o such building shall comply with the requirements of the class of buildings applicable to the purposes for which such portion of said building is to be used.

Passed, July 22, 1925.

450. **Conflict Between Special and General Provisions.)** Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance, or operation of any building or part of a building used for the purpose of any specified class, shall conflict with the general provisions of this chapter relating to the construction, equipment, maintenance and operation of buildings generally, the special provisions shall govern in each case, except in the case of Section 705, which shall govern in all cases coming within its provisions.

ARTICLE IV.

Buildings of Class I.

451. **Class I Defined.)** In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purpose of a barn, stable or a garage or for the housing or keeping of automobiles.

452. **Must Comply With General and Special Provisions.)** Every building of Class I shall comply with the general provisions applicable to the kind of building it is as set forth in this chapter and shall, in addition, comply with the following special provisions.

453. **Buildings—Construction of—in Relation to Height.)** (a) The construction of buildings of Class I shall be as follows: Buildings of Class I which are 100 feet in height or higher shall be built of fireproof construction.

(b) Buildings of Class I which are less than 100 feet in height and more than 50 feet in height shall be built of slow-burning, mill or fireproof construction. Buildings of Class I of slow-burning or mill construction shall not be built more than seven stories in height.

(c) Buildings of Class I of ordinary construction shall not be built more than four stories in height.

454. **Skeleton Steel Walls—Metal Lath and Solid Cement Plaster Covers.)** (a) A one or two story building used for the purposes of Class I, no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns, supporting steel trusses, with steel trusses and steel diagonals, designed to resist safely, within the safe limits of stress provided by this chapter, a wind pressure of twenty pounds per square foot, for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure, and in addition to the live load of 100 pounds per square foot provided for by this chapter, and any other live loads which may be imposed on such structure, may have exterior walls measuring not less than one and one-third inches thick of metal lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. Complete reinforced concrete framework, built in every manner equally as strong and as safe as provided for a steel frame, in this section, may have exterior walls built in the same manner of the same materials and of the same thickness.

(b) The enclosing walls of buildings which are built not less than fifty feet from any lot, alley or street line may be constructed of corrugated iron, supported on a steel frame built as specified in this section.

455. **Buildings for Explosives.)** (a) Buildings for the storage of fireworks and of similar substances or articles of an explosive nature shall have walls of masonry construction, shall not exceed one story in height, shall not exceed sixteen hundred (1,600) square feet in area unless such building is divided into areas of sixteen hundred (1,600) square feet or less by dividing walls the construction of which and the equipment of openings in same being in compliance with the requirements of Section 463 of this chapter. The roof of such building may be constructed of wood joists and roof boards covered with incombustible material or of wood joists covered with sheet metal or of common glass set in metal frames, but in every case at least thirty (30%) per cent of the area of such roof shall be constructed of common glass and metal frames. Such buildings shall be situated not less than one hundred feet from any other building or structure and shall be situated not less than one hundred feet from any lot line, or where such lot line abuts a street, alley or public thoroughfare said building shall be situated not less than one hundred feet away from the opposite side of such street, alley or public thoroughfare.

(b) Buildings erected for the collection or compression of acetylene gas at a pressure of exceeding fifteen (15) pounds to the square inch shall be of fireproof construction throughout and shall be located at least two hundred and fifty feet away from any other building or structure and at least two hundred and fifty feet from any lot line and any street, alley or public thoroughfare.

456. **Buildings for Housing Motor Driven Vehicles.)** (a) Every building or structure hereafter erected and every existing building or structure hereafter increased in size or otherwise altered or hereafter converted or used for the purpose of housing five or more self-propelled vehicles or other wheeled machines, containing in the tanks thereof volatile inflammable liquid for fuel or power, and all adjoining buildings and structures not separated therefrom by dividing walls of brick or concrete extending at least three feet above the roof and having openings, if any, protected on both sides by approved automatic fire doors, where such building or structure is more than one story and less than four stories in height shall be of fireproof construction throughout, or shall be equipped throughout with an automatic sprinkler system. Where any such building is two stories or less in height and complies in all other respects with the requirements for fireproof construction and the second floor area is co-extensive with the area of the building and without openings

other than for stairs and elevators, such one or two-story building as aforesaid may have a roof of ordinary, slow-burning or mill construction. Where any such building two stories or less in height has a mezzanine floor or floors with a total area larger than twenty per cent of the area of the building it shall be considered an additional floor and that part or those parts of building containing such additional floor or floors shall be separated from every other part of said building by a wall of brick or concrete built of thickness as required for enclosing walls by the provisions of this chapter, and such parts of building so separated by such dividing wall shall have no openings in their floors from story to story other than is required for stairs and elevators. The openings connecting the different areas of such buildings shall be protected by double automatic fire door equipment. Every such building or structure more than three stories in height shall be of fireproof construction throughout and shall be equipped throughout with an automatic sprinkler system. In all such buildings more than two stories in height all window openings, except in walls that adjoin a public street fifty feet or more in width, shall be equipped with approved metal frames and sash glazed with wired glass. Buildings less than three stories high shall comply with the requirements of Section 784 of this chapter. All floor openings in non-fireproof buildings shall be enclosed in walls of masonry of such thickness as required by the provisions of this chapter and shall extend from the ground through the roof of the building; in fireproof buildings, all elevator shafts and other vertical shafts except stairways shall be enclosed in every story with walls of brick, tile, plain or reinforced concrete at least eight inches thick, all stairways shall be enclosed in every story with walls of brick, tile or reinforced concrete at least four inches thick and all openings in such enclosing walls shall be equipped with approved automatic or self-closing fire doors. There shall be no basement in any such building, except for boiler room purposes, unless such building, including the roof and the protection of the roof beams and roof girders, is of fireproof construction throughout and is equipped throughout with an automatic sprinkler system, and with no floor openings between the basement and other floors, except for stairs and elevators, and such openings shall be enclosed in both the basement and first floor by walls of brick or concrete at least eight inches thick or of fireproof tile at least twelve inches thick and equipped with doors as hereinbefore specified. There shall be no openings from the boiler room except to the outside of the building. Where such building is on a lot that adjoins two streets or a street and an alley whose established grades are not at the same elevation the story whose floor is higher than two feet below the lower of these grades shall, for the purpose of this section, be deemed the first story of said building.

Buildings of fireproof construction, except buildings used as hospitals, theaters, churches, schools and public halls, may be used to house self-propelled vehicles, provided, however, that the portion of the building used for such housing is separated from all the other portions of the building; which separation shall be by walls or floors of solid brick or concrete, not less than twelve inches thick, having no openings into the other portions of the building. The floors of said portion of such buildings used for such housing shall be of solid concrete construction. All openings from floor to floor shall be enclosed with twelve-inch brick or concrete walls; all doors on these walls around floor openings to be standard metal fire doors, and shall be of a self-closing or automatic type. The portion of such buildings housing self-propelled vehicles shall be equipped with an approved automatic sprinkler equipment. All such buildings of eighty feet or more in height shall be equipped with inside standpipe fire lines subject to the approval of the Fire Commissioner. Where the floor area on one floor used for the purpose of housing self-propelled vehicles is in excess of 5,000 square feet, three sides of such portion of such buildings shall be at least fifteen feet removed from any other structure or building. Floor areas on one floor shall not exceed 12,000 square feet. Floor areas in excess of 12,000 square feet shall be divided into areas of 12,000 square feet, or less, by standard fire walls of twelve-inch brick or concrete, all openings in same to be protected by standard double automatic fire doors. The entrance to and exit from each floor containing self-propelled vehicles shall be by means of a fire shield stairway tower. All openings from said stairway tower shall lead to a platform open on one side to the open air, the open side to be protected by an approved railing or grating, and the opening to approximate 80 per cent of the wall area. All doors leading to this open platform to be standard metal self-closing fire doors. There shall be installed a vent shaft in that portion of the building housing self-propelled vehicles, equal to four square feet in cross-section area for each five cars capacity. Such vent shaft shall not be required where three sides of the compartment housing self-propelled vehicles open to a space of fifteen feet or more. This vent shaft shall be in addition to the normal ventilating requirements, and together with its appurtenances shall be installed in such manner as will meet with the approval of the Fire Commissioner.

Passed, July 22, 1925.

(b) Every building, structure or place not now used for the housing of four or less vehicles containing volatile inflammable liquid in the tanks thereof but hereafter converted to such use, and every building or structure hereafter erected for the housing of four or less such vehicles, where so used, must be occupied and used exclusively for such purposes under the following conditions and with the exceptions hereinafter noted:

Frame sheds or buildings may be so used if such shed stands at least five feet from every other building or structure on the same lot or plot of ground; provided, however, that in frame buildings used exclusively for Class I purposes a portion of such building may be so used if the part so occupied is separated from all other parts of the building by a brick dividing wall extending three feet above the highest point of the roof, and in such dividing wall all openings, if there are any, shall be equipped with standard automatic or self-closing fire doors on each side of the wall.

Brick buildings with roof of ordinary construction may be so used if they are located three feet or more from every other building or structure upon the same lot or plot of ground. In buildings of ordinary, slow-burning or mill construction used exclusively for Class I purposes, four or less such vehicles may be housed provided that part of the building so occupied is separated from all other parts of such building by a brick wall extending three feet above the highest point of the roof and in which the openings, if any, are equipped with approved automatic or self-closing fire doors on each side thereof. If such building is more than one story high in lieu of extending hereinbefore required wall through the upper stories and through the roof as described, the floor system immediately above space in which such vehicles are kept may be built of fireproof construction connecting with wall separating such space from other parts of the building and which is carried through the story so occupied by such vehicles.

Brick buildings with a roof of fireproof construction may be so used and may ad-

join any other building or structure, but no openings shall connect the same with any building other than a building of Class I.

Buildings containing not to exceed one living apartment and in which four or less vehicles containing volatile inflammable liquid are housed, must have brick or masonry walls and not exceed two stories in height. The floor of the second story shall be of fireproof construction throughout or if of combustible material shall be protected on the underside for the entire area of such floor by two complete coverings of metal lath and fire-resisting plaster applied separately. There shall be two stairways from said apartment to the ground placed as far apart as practicable, one of such stairways may be an outside stairway. The interior stairway or stairways shall be enclosed on the first floor by partitions of four-inch tile or partitions of metal lath and plaster on metal studding in such a manner that exit by means of the stairway shall be direct to the outside of building, and there shall be no doorways or other openings from enclosure containing such stairway into the first story.

457. **Buildings for Smoking Meats.)** Buildings or structures for the purpose of smoking meats or fish shall have brick walls and shall have a roof of fireproof construction. No combustible material shall be used in the erection of such building. Where smoke houses are built inside of another building, they shall be constructed entirely of metal or have brick walls with a fireproof roof or ceiling and no combustible material shall be used in their construction.

458. **Buildings for Dry Cleaning.)** Buildings in which machinery and equipment is installed for the purpose of dry cleaning shall stand at least fifty feet from any lot line and not nearer than fifty feet to the nearest point of approach of any other buildings or structure upon the same lot. Such buildings shall be of fireproof construction, shall not be over two stories in height and shall have no basement or attic. Walls shall be at least twelve inches thick. All window openings in outside walls shall be equipped with approved metal frames, metal sash and wired glass. All exterior and interior door openings shall be equipped with an approved three-ply laminated door covered with sheet metal or its equivalent in fire-resisting quality. There shall be no floor openings except for one interior stairway and said stairway shall be enclosed upon the first floor in such a manner as to give direct exit from stair and stair hall to the outside without any doorway or other opening from stair or stair hall to first story of building. An additional outside metallic stairway or additional stairways at least three feet wide shall also be provided. The boiler shall be located in a separate building and so situated that the line of travel for gases between any opening in boiler room and the opening in the dry cleaning or dry room shall be not less than twenty feet. Such dry cleaning and dry room shall be provided with vent holes at the floor line not less than sixteen square inches in area, at least six feet apart.

459. **Buildings for Motion Picture Films.)** Buildings for the storage of more than two thousand (2000) feet of motion picture films, or buildings in which more than two thousand (2000) feet of motion picture films are stored shall be of ordinary, slow-burning, mill or fireproof construction and not more than two stories high, unless of fireproof construction. In all buildings in which motion picture films are stored all elevators and stairs shall be enclosed in all stories where such film storage occurs, and in all stories above such stories where motion picture films are stored. In buildings of ordinary construction such stair and elevator enclosure shall be of brick walls at least twelve (12) inches thick supported on the ground or upon fire-proofed structural steel. In fireproof buildings all elevators and stairs shall be enclosed with brick walls at least eight (8) inches thick, or with reinforced concrete or with fireproof tile at least four (4) inches thick.

Vaults for the storage of motion picture films in non-fireproof buildings shall be of brick or of reinforced concrete at least twelve (12) inches thick. The floors and tops of such vaults shall be of brick or of concrete or of reinforced hollow tile at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick. In fireproof buildings vault walls shall be of either fireproof tile, brick, concrete or reinforced concrete. The floors and tops shall be of brick or of concrete at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick, or of fireproof tile or of reinforced hollow tile at least ten (10) inches thick. The thickness of vault walls shall be the same as herein specified for floors and tops where the same material is used for their construction, except that walls of fireproof tile shall be at least twelve (12) inches thick.

The vent flues for vaults shall be of the same construction as is required for smoke flues of the same area for such buildings. In fireproof buildings such vent flues may have walls at least four (4) inches thick of stone or gravel concrete reinforced with three-eighths (⅜) inch diameter round steel rods. Rods shall be set both vertically and horizontally, shall be spaced twelve (12) inches on centers where set horizontally and shall be spaced eighteen (18) inches on centers where set vertically. Or the walls may be four (4) inches thick of hollow clay tile set with the voids vertical and having all voids filled with stone or gravel concrete and with all joints filled with cement mortar and have metal bands at least one-fourth (¼) inch thick by one (1) inch wide embedded within the horizontal joints on all sides of the flue at intervals of not less than four (4) feet in height such bands being secured to metal plates four (4) inches square and one-fourth (¼) inch thick placed flat against the outside face of the tile, or bands shall be secured to each other in a manner to effectually prevent walls of the flue from spreading when subjected to heat. Where two or more flues are built together the bands may extend from outside to outside of the group or be arranged in such a manner as to effectually prevent the spreading of the walls of any flue within the group. Where tile is used for flues the exterior walls of detached flues or the outside walls of a group of flues shall be covered with two coats of cement plaster on wire lath brought close to the intersecting walls, floors and ceiling. Above the roof level tile walls shall be encased with four (4) inches of brick laid in cement mortar. Vent flues for vaults which are located in the top story of a fireproof building may be constructed of No. 14 U. S. gauge metal from the vault connection to the termination of the flue, and all that portion of the flue which is within the building and all that is not more than eighteen (18) inches above the roof shall have a coating of asbestos plaster at least two (2) inches thick covered with two coats of cement plaster on metal lath. Such other construction of vent flues will be permitted as will meet with the approval of a Board consisting of the Commissioner of Buildings and the Chief Fire Prevention Engineer and shall be regarded by such board as being equal in character and fire-resisting qualities to the foregoing.

In buildings of fireproof construction rooms for examining and for repairing motion picture films shall be enclosed in partitions of fireproof or incombustible material at least four (4) inches thick.

In buildings of fireproof construction rooms used for receiving, distributing or the shipping of motion picture films shall be enclosed in partitions or walls of brick or concrete or fireproof tile at least eight (8) inches thick, or of reinforced concrete at least six (6) inches thick.

Such partitions and the enclosing walls of such rooms, except where they face upon a public street at least fifty (50) feet wide, shall have window openings in same equipped with approved metal frames and sash and glazed with wired glass, and all door openings shall be equipped with approved single automatic-closing fire doors.

In non-fireproof buildings in addition to all of the above requirements, the floors and ceilings of such rooms or compartments must be of fireproof construction as defined in this chapter.

460. **Door Openings—Revolving Doors.)** (a) The aggregate width of door openings at or approximately at the street level in buildings of Class I shall be equal to the aggregate width of stairways, as specified in Section 878 of this chapter for buildings of Class I. Where locks are used on exit doors or on doors or gates leading to hallways or stairways which lead to exit doors they shall be so arranged that the door or gate may be opened from the inside without the use of a key. Where locks are used on automatic fire doors in stair shafts of buildings in which approved sprinkler systems are installed, said doors may contain just above the locking device a fire-resisting glass panel containing not less than 81 square inches nor more than 450 square inches of exposed fire-resisting glass. In every building of this class every door to an exit which is a means of egress for twenty or more persons shall open outward, and every door which is a means of exit from any floor above the first, shall open outwardly from the space or hallway in which the stairway from such upper floor is located. A door or doors when open shall not project over a public sidewalk or public space.

(b) Revolving doors shall not be installed in any door opening of any building unless the revolving wings of such revolving doors are so arranged that, by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said door fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed and all deficiency of required exits must be made up by additional doors.

461. **Existing Buildings of Class I — Increasing Height of.)** In all cases where buildings of Class I of ordinary construction built prior to March 13, 1911, are to be increased in height above the height of fifty feet, or of mill or slow-burning construction above the height of ninety feet, the additional parts of such buildings shall be constructed as herein provided for buildings over fifty feet in height or over ninety feet in height, respectively, and said additional parts shall be made to conform in all respects to the requirements for buildings of this class more than fifty feet in height or more than ninety feet in height, respectively, before it shall be lawful to occupy them.

462. **Fire Walls.)** (a) Buildings occupied by more than one person, firm or corporation, or for more than one business enterprise conducted by the same person, firm or corporation, in separate enclosures on any one floor, shall have a brick dividing wall for every fifty feet of street frontage, if of ordinary construction, or for every eighty feet of street frontage, if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall and such dividing walls and the doors therein shall be built in accordance with the provisions of Section 789 of this chapter.

(b) All of the partitions between the parts of such buildings occupied by different persons, firms or corporations, shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

(c) Only metal framed windows glazed with one-quarter inch thick wire glass may be used in such partitions.

463. **Dividing Walls—When Required.)** (a) Dividing walls will be required in buildings of Class I as follows:

(b) Every building of ordinary construction having a greater area than 9,000 square feet shall be divided into areas of 9,000 square feet or less by dividing walls; provided, however, that buildings of ordinary construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of ordinary construction with areas not greater than 9,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stair halls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief Fire Prevention Engineer may be built with an area of 12,000 square feet but if of greater area shall be divided into areas of 12,000 square feet or less by dividing walls.

(c) Every building of slow-burning or mill construction more than one story in height having greater area than 12,000 square feet, shall be divided into areas of 12,000 square feet or less by dividing walls; provided, however, that buildings of slow-burning or mill construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of slow-burning and mill construction having areas not greater than 12,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stairhalls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety, may be built of an area of 16,000 square feet, if of greater area shall be divided into areas of 16,000 square feet or less by dividing walls.

(d) Every fireproof building more than two stories in height and having greater area than 30,000 square feet, shall be divided into areas of 30,000 square feet or less by dividing walls.

(e) Where dividing walls are required in any of the above mentioned buildings, such building shall be subdivided by brick walls, built of the thickness given in the table for the thickness of enclosing walls and all doors or other openings in such walls shall have at each side of the same, iron

doors, tin clad doors or shutters, as described in Section 789 of this chapter, and said buildings as subdivided shall be provided with stairs and fire escapes the same as hereinafter required; provided, however, that one-story buildings of ordinary mill or slow-burning construction and two-story buildings of fireproof construction of any size when used as one store, room or workshop and occupied by only one person, firm or corporation, may be erected without any dividing walls.

464. **Display of Placard—Indicating Floor Strength—Fee.)** (a) It shall be the duty of the owner of every building of Class I now in existence or hereafter erected, or of his agent, or of the occupant, or person in possession, charge or control of same, to affix and display conspicuously on each floor of such building, a placard, stating the uniformly distributed load per square foot of floor surface, which may with safety be applied to that particular floor, as provided by this chapter, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the loads indicated upon such placards.

(b) It shall be the duty of the occupants of such buildings to maintain such placards during their occupation of the premises and it shall be the duty of the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be the duty of the owner, agent or lessee of each such building, now in existence, or hereafter erected, to procure and submit evidence of the correctness of the figures on such placards to the Commissioner of Buildings. Whenever such evidence as to the correctness of the figures shall be satisfactory to the Commissioner of Buildings, he shall approve such placards. Such placards so approved by the Commissioner of Buildings shall then be affixed upon the respective floors of the different buildings. The calculations and loads shall be in accordance with the provisions of this chapter.

(c) It shall be the duty of the owner, agent or lessee to pay to the City Collector a fee amounting to five dollars for each ten thousand square feet of floor area or less, for more than ten thousand square feet of floor area and not to exceed fifty thousand square feet of floor area ten dollars, for each additional fifty thousand square feet of floor area in excess of the first fifty thousand square feet of floor area ten dollars additional, and for issuing new placards in place of lost placards, the fee shall be for ten thousand square feet or less two dollars; for more than ten thousand square feet, five dollars. For the purpose of determining the amount of the fee herein required to be paid, every part of a structure separated by dividing walls as required by Section 463 of this chapter shall be considered as a separate building.

465. **Live Loads for Floors.)** The floors of all buildings of Class I hereafter erected shall be designed and constructed in such a manner as to be capable of bearing, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and the strength of such building shall be increased above the capacity to carry such a live load of one hundred pounds per square foot of floor surface, when the uses to which such building, or part thereof, is to be applied, involve greater stress. The calculations and loads shall be in accordance with the provisions of this chapter. In every building of Class I now constructed and in use, whenever it shall be found by the Commissioner of Buildings that the floors of same, or any part or parts thereof, are not capable of bearing, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be upon the same, a live load of forty pounds for every square foot of surface, he shall condemn the same and order such floor or floors to be repaired or reconstructed within a reasonable time by the owner or occupant thereof, and shall proceed in the manner prescribed in sections 402 and 403 of this chapter, and in such case it shall be unlawful for the owner or occupant to continue to use such building until the said floors shall be repaired or reconstructed in accordance herewith.

466. **Elevator Buildings.)** Elevator buildings intended solely for the receipt, storage and delivery of grain in bulk, shall be of fireproof construction as described in this chapter.

ARTICLE V.

Class II.

467. **Class II Defined.)** (a) In Class II shall be included every building referred to in subdivisions herein designated as Class IIa, Class IIb and Class IIc.

(b) In Class IIa shall be included every building used for office purposes, and also every building used for clubhouse purposes where sleeping accommodations are provided for less than twenty persons.

(c) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(d) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

468. **Must Comply with General and Special Provisions.)** Every building of Class II shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

469. **Load Bearing Capacity of Floors in Buildings of Class II—Doors and Door Openings, Requirements for.)** (a) For all buildings of Class II the floors shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds per square foot of surface, and such floor bearing capacity shall be computed in accordance with the provisions of this chapter.

(b) The aggregate width of door openings at, or approximately at the street level in buildings of Class II shall be equal to the aggregate width of stairways as specified in Sections 878, 879 and 880 of this chapter for buildings of Class II. Revolving doors may be installed in door openings of any building of Class IIa and Class IIb where the revolving wings of such revolving doors are so arranged that, by the application of a force more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said door fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the

doors are collapsed, and all deficiency of required exits must be made up by additional doors.

470. **Windows and Mechanical Ventilation.)** (a) In every building hereafter erected for or converted to the purposes of this class, courts shall be of the minimum widths and areas prescribed in Section 644 of this chapter, and vent shafts as defined in Section 634 of this chapter, shall be of the following minimum width and areas:

Height of Shaft.	Least Width in Feet.	Square Feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 or more stories	8	120

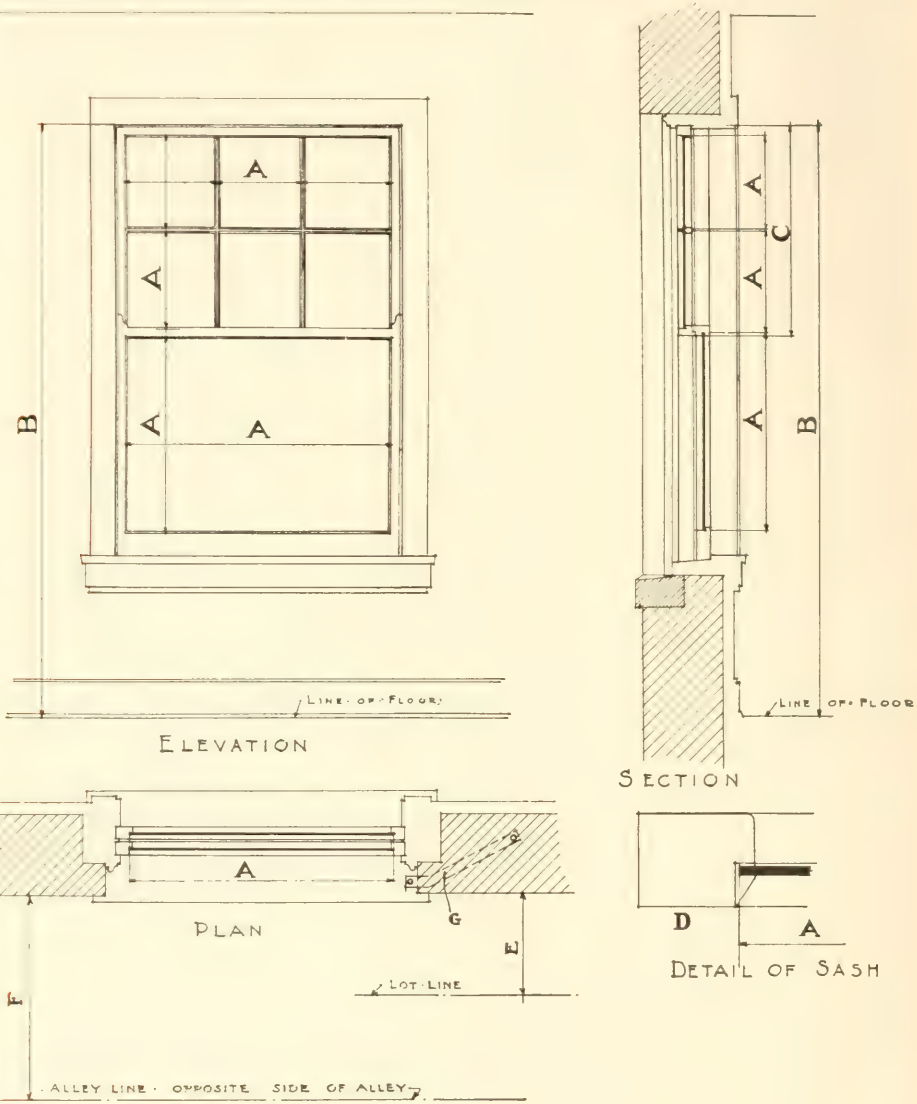

Fig. 2.

WINDOWS.

Sections 470b, 476, 488, 650, 677, 678, 784, 788.

(A) Where measurement of glass is taken.

(B) Top of window.

(C) One-half of window.

(D) Detail of sash showing where (A) is taken, under ordinary conditions.

Area of glass would be (A x A).

Total area would be summation of all (A x A).

Windows to be constructed so that upper half (C) can be opened.

(E) If E is less than 15 ft. wide, metal frames and wire glass to be used; and the glazed portion of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

(F) If F is less than 30 ft., metal frames and wire glass to be used; and the glazed portion of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

For exceptions where steel rolling shutters, etc., are used see ordinance. (Sec. 784a).

(G) Provision made for safety device in cleaning of windows. (Sec. 788).

(b) In every building hereafter erected for or converted to the purposes of this class, every room used as a private sitting room or as a sleeping room, shall have at least one window which opens directly upon a street, alley, yard or court. The total glass area of such window or windows opening directly upon a street, alley, yard or court shall be not less than one-tenth of the floor area of such room. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened. No such window shall have a glass area of less than ten square feet unless it be a window in excess of the one-tenth of the floor area as required by this paragraph. Provided that sleeping cells in prisons, jails, police stations and houses of detention need not have each a window opening directly on a street, alley, yard or court if such cells are in a cell block which has windows with a glass area equal to one-fourth of the floor area of such block and arranged so that each window may be opened for one-half of its area, and provided further that such cell block and cells shall be equipped with a system of mechanical ventilation approved by the Commissioner of Health.

(c) In every building hereafter erected for or converted to the purposes of this class, every pantry, bath room and water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such window or windows opening directly upon a street, alley, yard, court or vent shaft shall be not less than one-tenth of the floor area of such room or compartment. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened; and no such window shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located in the upper story of any such building, may be lighted and ventilated by means of a skylight having a glass area equal to one-tenth of the floor area of the room it serves and be equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth of the floor area of such room; and provided further, that any such room or compartment in a building used for office, club, hospital or hotel purposes, in lieu of such window or windows, may be ventilated by an approved mechanical ventilation system which shall effect at least six complete changes of air per hour.

(d) In every building hereafter erected for or converted to office, hotel or club purposes, every room, except a room used as a bakery, which is below street grade and which is frequented by the public or in which there are regularly employed five or more persons, shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; provided that in case of store rooms below street grade having 1,500 cubic feet of space per person employed therein two changes of air per hour will be deemed sufficient. In buildings of this class every room, either above or below grade, used as a bakery, shall comply with the provisions of the ordinances of the City of Chicago in respect to bakeries.

(e) In every building hereafter erected for or converted to the purposes of this class, every room not otherwise specifically provided for in this section shall, where practicable, have a window or windows, with a total glass area not less than one-tenth of the floor area of such room, opening directly onto a street, alley, yard or court, and no such window shall have a width of less than one foot or a total glass area of less than ten square feet, unless such window is in excess of the ten per cent of floor area requirement; provided that, if it be impracticable to ventilate any such room by windows as aforesaid, such rooms shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; the air supply being taken from the outer air at a point not less than ten feet above the street level.

(f) It shall be the duty of the owner, agent, architect, or party in possession or control of any building in which a mechanical system of ventilation shall have been installed under the requirements of this section, upon completion of such system, to notify the Commissioner of Health in writing at least twenty-four hours in advance of the making of a test of such system; and each such system or unit shall be tested for volumetric efficiency by the owner or his representative in the presence of the representative of the Commissioner of Health and such system shall not be considered as meeting the requirements of this section until it shall have been approved by the Commissioner of Health. Every such mechanical ventilating system shall at all times be kept in good repair and in operation so as to insure the required ventilation of all rooms and compartments planned to be ventilated thereby, during all hours of human occupancy.

Class IIa.

471. **Class IIa Defined.)** In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

472. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIa which are ninety feet or more in height shall be built entirely of fireproof construction.

(b) Buildings of Class IIa less than ninety feet and more than fifty feet in height shall be built either of slow-burning, mill or fireproof construction.

(c) Buildings of Class IIa not exceeding fifty feet in height may be built of ordinary construction.

Class IIb.

473. **Class IIb Defined.)** In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

474. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIb more than five stories and basement high shall be of fireproof construction.

(b) Buildings of Class IIb more than three stories and basement high but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

475. **Walls—Divisions and Partitions—Fire Stops.)** (a) In buildings hereafter erected used wholly, or in part for the purposes of Class IIb of ordinary, slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions of all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried

on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

476. **Sleeping Stalls in Rooms—When Allowed.)** Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shall not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

(See Illustration Sec. 470b.

Class IIc.

477. **Class IIc Defined.)** In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

478. **Buildings—Construction of—Height of.)** (a) All buildings of Class IIc not more than two stories and basement in height may be of ordinary, mill, or slow-burning construction.

(b) All buildings of Class IIc more than two stories and basement in height shall be of fire-proof construction.

479. **Frontage Consents for Hospitals.)** It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any hospital in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building fronts and faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

480. **Coves in Rooms and Corridors of Hospitals.)** In every building hereafter constructed for or converted to hospital purposes, in all corridors and rooms used by patients, all intersections of walls, floors and ceilings shall be formed with tangent coves.

481. **Elevators in Hospitals.)** . Every building over three stories in height hereafter constructed for or converted to hospital purposes shall have at least one elevator, the floor dimensions of which shall be not less than seven feet by five feet, and said elevator shall be enclosed in a fireproof shaft with incombustible doors closing off each opening and shall comply with all the general provisions of this chapter.

482. **Fire Escapes, Balconies, Platforms.)** All buildings of Class IIc shall be equipped with stairway fire escapes not less than three feet in width which shall, in number, location and structural features, comply with the general provisions of this chapter relating to fire escapes. The balconies and platforms of such fire escapes shall be not less than three feet in width and may be made with a smooth surface of incombustible material laid flush with the floor and with a pitch of one-third inch to the foot.

ARTICLE VI.

Class III.

483. **Class III Defined.)** In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for twenty or less persons or where not more than ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

484. **Must Comply With General and Special Provisions.)** Every building of Class III shall comply with the provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

485. **Buildings—Construction of—Height of—Space Occupied on Lot.)** (a) Every building of Class III which is ninety feet or more in height shall be built entirely of fireproof construction.

(b) Every building of Class III less than ninety feet and more than fifty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

(c) Every building of Class III less than fifty feet in height may be built of ordinary construction.

(d) The amount of space occupied on any lot by Class III buildings shall comply with the requirements of Section 642 of this chapter.

(e) Buildings used for garage purposes only, having a ground area of four hundred (400) square feet or less, may be built with enclosing walls and roof of corrugated iron or galvanized sheet steel supported on a frame of steel construction.

486. **Skylights—Construction of — Glass in.)** (a) The skylight on the roof of every building of Class III erected within the fire limits shall have its sides, sashes and frames constructed of metal or of metal-clad wood on all exterior surfaces.

(b) Such skylights shall be covered by a strong wire netting with mesh not more than one and one-half inches square placed not less than six inches above the glass, supported on uprights of incombustible material, unless wired glass is used.

487. **Allowances of Live Loads in Construction of Floors.)** In every building of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface.

488. **Habitable Rooms—Definition of—Requirements as to Size and Ventilation.)** (a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in Section 634 of this chapter; provided, that there shall be a space of at least three feet between the building and the lot line on one side, and a space of at least one foot between the building and the lot line on the other side. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of less than eight feet and six inches; provided that attic rooms need not be eight feet six inches high for more than one-half of their area, and provided further that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the Commissioner of Buildings and the Commissioner of Health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section. (See Illustration Sec. 470b).

489. **Alcoves.)** Every alcove and alcove room shall comply with the requirements of Section 648 of this chapter.

490. **Pantries, Bath Rooms, Water Closet and Urinal Compartments—Requirements in Relation Thereto.)** In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in Section 634 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

491. **Bay Windows and Light Shafts—Materials For.)** Bay or oriel windows may be built of combustible material on front or rear elevations of buildings of Class III of two stories or less in height, within the fire limits, provided such bay and oriel windows shall not have a greater width than twelve feet at the wall line of the building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows, when so constructed, shall be covered with sheet metal or other incombustible material. Light shafts wholly within the walls of a two-story building of Class III may be built of combustible material covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

492. **Walls—Brick Walls Upon Wooden Sills—Level of Sills Allowed.)** Every building of Class III not exceeding one story or twenty feet in height from top of sills to the highest point of the roof, and with the side walls not exceeding fourteen feet in height, and with floor area not exceeding twelve hundred square feet, may have brick walls not less than eight inches in thickness erected upon wooden sills, the sills supported on iron, masonry, or concrete supports extending four feet below the surface of the ground, provided that the portion of the supports above the ground may consist of cypress or cedar posts. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart, to support with safety the weight that may rest upon them; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. Every building more than one story and less than two stories high, having a gable or hip roof with a rise of not more than thirty degrees, may have eight-inch walls of solid brick or stone masonry, provided the side walls do not exceed fourteen feet in height measured from the first floor joist, and provided such building has a floor area not exceeding 1,200 feet and is not over 22 feet in width.

493. **Stairways in Buildings of Class III Three Stories or More in Height.)** (a) In every building of Class III hereafter erected and three stories or more in height, there shall be either two stairways from the first to the top story or one such stairway and a stairway fire escape.

(b) In every building of Class III now in existence, and three stories or more in height with a floor area of 1,000 square feet above the second floor, which is not equipped with two stairways or with one stairway and a stairway fire escape, safe and adequate means of egress from all floors shall be provided by the erection of additional stairways or stairway fire escapes, or such other means as in the judgment of the Commissioner of Buildings are required for the safety of the occupants of such building or the public.

(c) In every building of Class III now in existence or hereafter erected used for hospital, home, day nursery or asylum purposes there shall be provided at least two stairways located as far apart as practicable and extending from the top story to the ground. A separate door exit shall be provided for each stairway to the outside of the building.

ARTICLE VII.

Class IV.

494. **Class IV Defined.)** (a) In Class to in subdivisions herein designated as Class IVa, Class IVb, Class IVc and Class IVd, as follows:

(b) In Class IVa shall be included every building used as a church or place of worship.

(c) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(d) Class IVc shall include every building hereafter erected used for moving pic-

ture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred; provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(e) In Class IVd shall be included every grandstand and every baseball, athletic and amusement park.

495. **Must Comply With General and Special Provisions.)** Every building or structure of Class IV shall comply with the general provisions of this chapter and shall, in addition, comply with the following special provisions:

496. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct or alter any Class IV building except in conformity with the ordinances of the City of Chicago relative thereto, or to operate any Class IV building that does not conform thereto.

497. **City Officials Empowered to Enter.)** The Commissioner of Buildings, Commissioner of Health, Commissioner of Gas and Electricity, Fire Commissioner, Chief Fire Prevention Engineer, Superintendent of Police, and their respective assistants, shall have the right to enter any building used in whole or in part for the purposes of Class IV at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

498. **City Officials Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV, to be closed, where it is discovered that there is any violation of any of the provisions of this chapter, and kept closed until the same are complied with.

499. **Theaters in Frame Buildings Prohibited.)** No frame building or part thereof shall be used as a moving picture, vaudeville or other theatre.

500. **Buildings — Height — Construction — When Used in Part as Class IV.)** Every building higher than sixty feet, used in whole or in part for the purposes of Class IV or connected with or made part of any building so used, shall be entirely of fireproof construction. Every such building less than sixty feet in height shall be made of fireproof, slow-burning or mill construction, except as provided in this chapter.

CLASS IVa

501. **Class IVa Defined.)** In Class IVa shall be included every building used as a church or place of worship.

502. **Frontage—Seating Less Than Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity of 800 persons or less, shall have for the auditorium a frontage upon two open spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

503. **Frontage—Seating Over Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity greater than eight hundred persons, shall have a frontage upon three open spaces of which at least one shall be a public street and the others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street or alley, with at least one exit into each open space.

504. **Construction of.)** Every building of Class IVa, which has a seating capacity of less than 600 may be built of ordinary construction. Every building Class IVa having a seating capacity of more than 600 and less than 1,800 shall be built of slow-burning mill or fireproof construction.

505. **Fireproof Construction Necessary When.)** Every building of Class IVa having an aggregate seating capacity greater than 1,800 persons shall be built of fireproof construction.

506. **Limitations of Floor Level in Class IVa—Height Above Sidewalk.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVa, shall be as follows:

(b) No auditorium of a greater seating capacity than 1,000, shall have the highest part of its main floor at a greater distance than 10 feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVa having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVa, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVa and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear and shall be equipped with emergency exits and not less than one stairway fire escape.

507. **Allowance for Live Loads in Construction of Floors in Buildings of Class IVa—Stairways—Width of Entrances and Exits.)** Every floor in buildings of Class IVa shall be designed and constructed in such a manner as to be capable of bearing in all its parts, in addition to the weight of floor construction, partitions, and permanent fixtures that may be set upon same, a live load of 100 pounds for every square foot of surface on such floor. The width of stairways in buildings of this class shall be twenty inches for every one hundred of the aggregate seating capacity, and for fractional parts of one hundred seating capacity, a proportionate part of twenty inches shall be added to the width of such stairway, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided, and provided that in any such building having a gallery, the seating capacity of which does not exceed two hundred and fifty persons, two separate and distinct stairways, each not less than three feet wide, shall be permitted.

508. **Galleries — Exit and Entrance.)** Distinct and separate exits shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the gallery or galleries, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such gallery or galleries to such place of exit or entrance. Not more than two galleries, placed one above the other, shall be permitted in any building of Class IVa.

509. **Width of Aisles—Steps in Aisles.)** Aisles in buildings of Class IVa shall, in the aggregate, be eighteen inches in width for each 100 of the seating capacity of the auditorium, and for fractional parts of 100 a proportionate part of 18 inches shall be added, but no aisle shall be less than two

feet six inches in width in its narrowest part. Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than 5 inches, the floor of the aisles shall be made on an inclined plane; and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

510. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of corridors, passageways, hallways and doors, adjacent to, connected with, or a part of the auditorium, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such doorway shall be less than three feet in width.

511. **Seats, Number of, in Rows.)** There shall not be more than fourteen seats in any one row between aisles. Rows of seats shall not be less than two feet eight inches from back to back, and no bank of seats shall be of greater rise than twenty inches.

512. **Emergency Exits—All Doors to Open Outward.)** (a) Emergency exits and outside stairways shall be provided for every building of Class IVa, which has a larger seating capacity than 800. Such emergency exits shall be one-half the aggregate width of the main exits, but no such emergency exits shall be less than three feet in width. Provided, that such stairways may be built inside the walls of the building in a corridor or passageway not less than seven feet wide and enclosed by a fireproof partition not less than four inches thick. Such stairway shall be of fireproof construction. All emergency exits and stairways therefrom shall be kept free from obstructions of any kind including snow and ice.

(b) All doors affording egress, directly or indirectly from the auditorium to a street or alley, shall open outward. Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the time that the building is occupied, and shall be so constructed and maintained that they may be easily opened from within.

513. **Buildings in Which Seats are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this class in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVa standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of such floor shall be estimated alone as determining the kind of construction under this article.

514. **Lighting Service Requirement.)** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVa. Provisions shall be made to properly light every portion of a building of Class IVa and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purpose of Class IVa provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

Class IVb.

515. **Class IVb Defined.)** In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

516. **Frontage—Seating Eight Hundred or Less—Seating More than Eight Hundred.)** (a) Every building of Class IVb, containing a hall or halls of an aggregate seating capacity of 800 persons or less, shall have a frontage upon two public spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

(b) Buildings of Class IVb, containing halls or rooms, used for the purpose of Class IVb, of greater aggregate seating capacity than 800, shall have a frontage upon three open spaces, of which at least one shall be a public street, while the other two, if not streets, shall be public or private alleys, of a width of not less than ten feet, each opening directly on a public street or alley; provided that a fireproof passageway at grade level, and not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public thoroughfare.

517. **Auxiliary Buildings—Height and Construction of—Communicating Doors.)** (a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IVb, shall, if sixty or less feet in height, be of fireproof, mill or slow-burning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof construction.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IVb now existing or hereafter constructed, unless there is, between such buildings, a fire wall constructed as required by Section 732 of this chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 789 of this chapter.

518. **Existing Buildings—Used for Class IVb and for Other Purposes.)** No part of an existing building, other than of fireproof construction shall be used for the purposes of Class IVb unless such part is separated from all portions of the same building used for other purposes by a fire wall constructed as required by Section 732 of this chapter and extending from the ground to the roof and unless all openings in such fire wall are equipped with automatic double fire doors as required by Section 789 of this chapter; in which case such other portions may be constructed in the manner permitted for separate buildings of such class.

519. **Construction—Depending on Capacity.)** Every building used for the pur-

pose of Class IVb, hereafter erected, containing a hall or room of an aggregate seating capacity of not more than 1,500 persons, shall be built of mill, slow-burning or fireproof construction. Every building hereafter erected to be used for theatrical purposes with a seating capacity greater than three hundred shall be built to conform to the requirements of buildings of Class V hereafter erected. If a hall or room or halls or rooms have a total seating capacity of more than 1,500 persons, such building shall be built of fireproof construction; provided, that buildings mainly used for exposition or exhibition purposes, and not used for theatrical purposes, and not exceeding two stories in height which have for public use only a main floor and one gallery and which have their walls and structural members of incombustible material and which comply with the provisions of this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any and all draperies, buntings, or other inflammable decorations shall be treated with a fire-retarding solution, subject to the approval of the Chief Fire Prevention Engineer.

520. **Buildings in Which Seats Are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this Class, in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVb standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.

521. **Limitations of Floor Levels—Height Above Sidewalks—Skating Rinks.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVb, other than skating rinks, shall be as follows: No auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than fourteen feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVb having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVb, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVb and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than four feet wide in the clear and such floor or floors shall be equipped with emergency exits and have not less than one stairway fire escape.

(b) In buildings of fireproof construction hereafter erected, banquet halls or ball rooms having a seating capacity of not more than 900 may be located on any floor. Such banquet halls or ball rooms shall have access to at least two interior stairways and persons for whom accommodations are provided in said banquet hall or ball room.

In buildings of fireproof construction herenot less than one stairway fire escape, the combined width of which shall be equal to at least 18 inches for each one hundred after erected, banquet halls, lodge halls, society halls or drill halls used for lodge purposes, having a seating capacity of not more than 1800, may be located on any floor eighty feet or more above the adjacent sidewalk grade, where all parts of said building above such height are used exclusively for lodge or society purposes. Such banquet halls, lodge halls, society halls or drill halls shall have access to at least four interior stairways, and not less than four stairway fire escapes, the combined width of which shall be equal to at least 18 inches for each one hundred persons for whom accommodations are provided in said banquet halls, lodge halls, society halls or drill halls. Where an interior stairway in such a building is enclosed in a tower and built as required by the provisions of Section 881, paragraph (n) of this chapter, then such stairway shall be considered the equivalent in "Width of Stairs" of two open stairways, or an open stairway and a fire escape. Drill halls used for lodge purposes, having a main floor seating capacity of not more than 1800 may, in addition, have a spectators' balcony having a seating capacity not to exceed 500. Such spectators' balcony shall have at least two interior stairways, not less than four feet wide, and at least two exterior fire escapes, not less than three feet wide, and shall be in accordance with provisions of Sections 524 to 529, both inclusive, of this chapter. Where adjoining buildings, or buildings on opposite sides of an open space, used for the same purposes, or for office purposes, and operated by the same persons, firm or corporation, are connected on each floor by enclosed fireproof bridges or passageways with fireproof doors at each end of bridge or passageway, or by fireproof vestibules with doors built and equipped as required by this Chapter for dividing wall doors, then said bridge or passageway, or vestibule, may be considered to be equivalent to a stairway for each of the two areas.
Passed December 12, 1923.

(c) No room or hall used for the purposes of a skating rink shall be constructed, operated or maintained with its main floor level more than two feet above the inside sidewalk grade of the street upon which such building containing same fronts, or more than one foot above the ground level in front of such building when it does not face upon a street, or more than one foot below the inside sidewalk grade of the street upon which such building fronts, or more than one foot below the ground level in front of such building when it does not face upon a street.

522. **Allowance for Loads in Construction of Floors.)** All floors of all buildings of Class IVb shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor, in accordance with the general provisions of this chapter.

523. **Stairways—Entrances and Exits—Handrails—Width of.)** The width of stairways in buildings used wholly or in part for the purposes of Class IVb, shall be 18 inches for every 100 persons of the aggregate seating capacity of all rooms used for the purposes of Class IVb in such buildings; but no stairway in such building shall be less than four feet wide in the clear; provided, that in any such building having a room or rooms, balcony or gallery, used for the purposes of Class IVb, the aggregate seating capacity of which does not exceed 250 persons, two separate and distinct stairways, each three feet wide, shall be permitted, but no such building hereafter erected shall have less than two interior stairways of the width required by this ordinance, and located as far apart as practicable. Every hall or room used for the purposes of Class IVb in a building hereafter erected, shall have access to not less than two stairways.

Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater height than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs. Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than 2 feet 6 inches wide in the clear when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

524. **Balconies and Galleries—Designation of.)** Where there are balconies or galleries, the first balcony or gallery shall be designated "balcony" and the second and third balconies or galleries shall be designated respectively "gallery" and "second gallery."

525. **Balconies and Galleries—Exit and Entrance.)** Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate required capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

526. **Aisles—Steps in Aisles—Passageways—Cross Aisles Leading to Emergency Exits.)** (a) Aisles in rooms used for the purposes of Class IVb shall have in the aggregate a width of 18 inches for each 100 of the seating capacity of such room, and for fractional parts of 100 a proportionate part of 18 inches shall be added; but no aisle shall be less than two feet six inches in width.

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

527. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such door shall be less than three feet in width.

528. **Seats—Number in Rows.)** There shall be not more than fourteen seats in any one row between aisles, and in a room or rooms used for the purposes of Class IVb, of a seating capacity greater than 400 persons, there shall be an aisle on each side of any bank of seats, where there are over seven seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall be of a greater rise than twenty inches.

529. **Emergency Exits.)** (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purposes of Class IVb which have a seating capacity larger than eight hundred, and such emergency exits shall have a width equal to one-half of the width provided for the main exits and such emergency exits shall lead directly to a public thoroughfare. Provided, however, that any room or rooms used for the purposes of Class IVb in any building hereafter erected, having a seating capacity of more than 400, shall have emergency exits outside of the walls of such building equal in width to one-half of the exits required for the main exits, and such emergency exits shall lead directly to a public thoroughfare. Doors leading to emergency exits shall not be less than three feet wide. Stairs shall not be less than four feet wide. Such emergency exits and stairways may be built inside the walls of such building of a width not less than four feet, provided that they are enclosed by a fireproof partition not less than 4 inches thick; and provided further, that the stairs themselves are constructed of incombustible material. Emergency stairways may descend into open spaces or passageways, provided they do not obstruct more than one-half of the width of such open spaces or passageways.

(b) Every stairway fire escape shall be located and constructed in accordance with the requirements of Sections 881, 882 and 885, but in no case shall any room used for the purposes of Class IVb located above the third story of any building have less than one stairway fire escape.

530. **Doors to Open Outward.)** All doors affording access directly or indirectly to the street, alley or corridor from any room used for the purposes of Class IVb shall open outward.

531. **Walls Between Auditorium and Stage.)** There shall be a solid brick wall of the same thickness as required for outside walls between the auditorium and stage in buildings hereafter erected for or converted to the use of Class IVb and used either wholly or in part for that purpose; and in existing non-fireproof buildings such wall must extend to a height of three (3) feet above the roof. Provided, however, that in existing buildings any room used for the purposes of Class IVb on or before March 13, 1911 having a greater seating capacity than four hundred (400) shall have a proscenium wall built of masonry or incombustible material.

532. **Curtain Shall Be of Iron, Steel or Asbestos—Inspection of—Fee.)** The main curtain opening in any such room shall have a wrought iron or steel or three-ply asbestos curtain with a wire mesh imbedded therein, which shall be inspected by the Department of Building semi-annually, for which inspection a charge of five dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

533. **Structures Over Ceiling—Construction.)** If any structure intended to be occupied by people is built over the ceiling of any room, used wholly or in part for the purposes of Class IVb, the girders or trusses supporting the same shall be of steel protected with fireproofing as required for interior columns in Section 839.

534. **Standpipe and Hose on Stage.)** In every room used for the purpose of Class IVb and having a seating capacity of 250 or more, and where scenery is used, a standpipe with hose connection and hose shall be installed on each side of the stage under the direction of the Chief Fire Prevention Engineer.

535. **Vents of Flue Pipes.)** (a) One or more vents of flue pipes of metal construction or other incombustible material approved by the Commissioner of Buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches, or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

536. **Fuse Boxes.)** Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the Commissioner of Gas and Electricity.

537. **Capacity—Certification for License.)** (a) The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVb may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

(b) No amusement license shall be issued for any room used for the purposes of Class IVb until the Commissioner of Buildings shall first have certified, in writing, that such room complies with the provisions of this chapter in every respect.

538. **Lighting Service Requirement.** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVb but the use of gas is prohibited in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVb and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of Class IVb provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

539. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

"Movable scenery" shall include all scenery, drop curtains, borders and wings which are made movable for the purpose of changing scenery and substituting another set during or between the various stage acts.

540. **Scenery to be Non-Inflammable.)** All scenery or stage paraphernalia of any sort used upon the stage of any room used for the purpose of Class IVb shall, previous to such use, be treated with a fireproof solution and shall be tested and approved by the Chief Fire Prevention Engineer.

541. **Amount of Scenery Allowed—Sprinkler System.)** Two sets of house scenery and three drops, exclusive of asbestos fire curtain and picture screen shall be allowed in existing rooms used for theatrical purposes in buildings of Class IVb where the same are on the first floor level, or in a building of fireproof construction or which conformed with the requirements of fireproof buildings at the time same was erected, and the same shall also be allowed in such existing rooms used for theatrical purposes above the first floor level when the seating capacity of such room does not exceed 300. Such scenery shall be known and designated upon the licenses issued by the city as "Permanent House Scenery," and the use and moving of such scenery shall not be construed as placing said building, hall, room or theater within the provisions of the ordinance relating to Class V buildings.

A set of house scenery as contemplated by this section is hereby defined to mean sufficient scenery to make one stage setting, such scenery being in continuous use in such house; provided, however, that the lowering of a drop shall not constitute a new stage setting.

No other scenery except as above enumerated shall be permitted on, above or underneath the stage.

Every existing Class IVb theatre affected by this section shall be equipped with an approved sprinkler system and also with stand-pipe and hose subject to the approval of the Chief Fire Prevention Engineer.

No Class IVb theatre in existence on March 13, 1911 affected by this section shall increase its seating capacity beyond its capacity on July 22, 1912.

No scenery or stage paraphernalia of combustible materials shall be used on the stage of any room or theatre used for the purposes of Class IVb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and all such treated scenery or stage paraphernalia, or both, shall be tested and approved by the Chief Fire Prevention Engineer.

542. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing room shall be properly ventilated, as in the judgment of the commissioner of health may be required.

CLASS IVc.

543. **Class IVc Defined—Moving Picture and Vaudeville Shows—Seating Capacity.)** Class IVc shall include every building hereafter erected used for moving picture or vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided that every building of Class IVc existing at the time the passage of the ordinance known as The Chicago Code of 1911 shall comply with the provisions of Class IVb. All buildings hereafter erected for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, with a seating capacity of over three hundred, and for the exhibition of moving pictures only, where the seating capacity is more than one thousand, shall be built to conform with the requirements for buildings of Class V hereafter erected as contained in this chapter. Buildings for the exhibition of moving pictures only and with a seating capacity of over three hundred, but not to exceed one thousand, shall also be built to conform with the requirements for buildings of Class V hereafter erected, in all their structural requirements and equipment except in so far as such requirements and equipment are modified in Sections 544 and 545 hereof.

544. **Frontage of Class IVc — Frontage, Open Spaces and Fireproof Passageways of Moving Picture Theatres Containing a Seating Capacity of more Than Three Hundred.)** Every room used for the purposes of Class IVc shall have a frontage upon at least two public thoroughfares, of which at least one shall be a street, and the other a street or a public or private alley not less than ten feet wide and opening directly on a public street or alley.

Buildings for the exhibition of moving pictures only, with a seating capacity of over three hundred but not to exceed one thousand, shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten feet in width. Except as hereinafter otherwise provided, the audience room of such building shall have either a public thoroughfare or an open space unobstructed from the ground to the sky on each side thereof. Such open space, when the audience room has a capacity not to exceed six hundred seats, shall be five feet wide, and six inches shall be added to the width of same for every additional one hundred seats in said audience room up to the maximum of one thousand seats. In all cases where there is a public alley in the rear of such building, said open space must connect directly with the alley. In case the entire audience is seated on the ground level said open spaces shall extend alongside of the audience room so as to connect with exit doors placed approximately in the middle of the audience room between the opposite ends of same. Where there is a balcony or gallery installed, such open spaces must extend along the entire length of the audience room so as to connect with exits from the balcony or gallery at their highest and lowest levels. Where such a building is located on a corner lot and adjoins a public street on one side and a public street or an alley not less than ten feet wide on two of the remaining sides and the building is so located that it adjoins such public thoroughfares on three sides for its entire extent, it shall not be necessary to construct an open space on the remaining side thereof, but in all such cases there shall be either an open space unobstructed from the ground to the sky or a fireproof passageway at least five feet wide leading from the side of the audience room not bordering on a street or other public space to the street in front of the theatre and another leading to the alley or other public space in the rear of the theatre. If the seating capacity of such theatre is over six hundred, six inches shall be added to the width of such open space or passageway for every one hundred seats or fraction thereof in excess of six hundred and up to the maximum of one thousand. If access to the street and alley or other public space as herein provided is by means of a fireproof passageway, such fireproof passageway must be constructed in all respects according to the provisions of Section 610 except as herein otherwise provided.

545. **Construction.)** Buildings of Class IVc hereafter erected, of a seating capacity not to exceed three hundred, shall not be built more than thirty feet in height and may be built of ordinary construction, but the enclosing walls shall be constructed of masonry. No moving picture, vaudeville or theatrical show shall hereafter be installed in a frame building. No room or hall used for the purposes of Class IVc shall hereafter be installed underneath any living or sleeping room.

Buildings for the exhibition of moving pictures only with a seating capacity of more than three hundred but not to exceed one thousand, when the same shall be located as provided for in Section 544 hereof, may be built as herein provided. Said buildings shall contain no stage, proscenium wall nor scenery of any description. The screen for the display of the pictures must be attached to the rear wall of the building, not to exceed six inches away from same. No decorative walls or paintings or other effects shall be constructed inside the audience room in such a manner as to allow any rooms or spaces between same and the enclosing walls of the building. An open platform not to exceed seventy-two square feet in area may be built before the picture screen in moving picture theaters having a seating capacity of not more than three hundred, and the said platform may have an additional twenty-four square feet in area for each additional one hundred in seating capacity in excess of three hundred. On the main floor of such building there shall be at least two main aisles with direct exits at front and rear and two cross aisles with direct exits from the side. When such building contains a balcony or gallery there shall be emergency exits from the highest and lowest levels of same on one side and on the other side there shall be either emergency exits or enclosed interior stairs from the highest level of the balcony, and the lowest level of the balcony shall be connected with such side stairs by means of a tunnel. All seats in the audience room shall be at least twenty inches wide and space thirty-four inches from back to back. The booth for the moving picture machine must be of construction in conformity with the requirements for such machine booths in buildings of Class IVc; in all other respects such buildings shall comply both in structural requirements and equipment with the provisions of this chapter relating to theatres of Class V hereafter erected.

Provided, however, that where such building has no balcony or gallery and the seats in the audience room are all on the ground floor of same, and where no portion of the building connected with or made a part of or used in conjunction therewith exceeds two stories in height, and where the lobbies and entrances leading to such part of the building used for purposes of Class IVc have brick dividing walls separating them from the portions of the building connected therewith used for the purpose of any other class as defined in this ordinance, and the floors of said lobbies and entrances and the floors and ceilings above such lobbies and entrances are of fireproof construction and there are no doors or windows leading from such lobbies and entrances to any portion of the said building used for any other purpose than Class IVc, such portion of said building as is not used for purposes of Class IVc may be built in accordance with the provisions of this chapter designating the manner of construction for such classes.

546. **Floor Levels—Limitations.)** The following limitations of floor levels shall apply to every building used for the purposes of Class IVc; the highest part of the auditorium floor shall not exceed four feet above the sidewalk level. The floor level at the entrance shall not be at a greater height than eight inches above the sidewalk. The aisles shall not have a greater incline than 1½ inches to the foot.

547. **Stairways—Handrails.** Where external stairways are required, such stairways shall be at least six inches wider than the exits, and shall have treads not less than ten inches wide and risers not more than 8 inches high, and shall be provided with suitable handrails on each side thereof, and the width of such stairs shall comply with the requirements of Class IVb.

548. **Balconies and Galleries.)** In nonfireproof buildings hereafter erected for, or converted to the purposes of Class IVc, not more than one balcony and no galleries shall be constructed.

549. **Width of Aisles—Steps in Aisles.)** Aisles and rooms used for the purpose of Class IVc shall have in the aggregate a

width of not less than twenty inches for each 100 of seating capacity of such room and for fractional parts of 100 a proportionate part of twenty inches shall be added, and no aisles shall have a width of less than two feet six inches. When side emergency exits are permitted, there shall be a cross aisle not less than three feet wide, leading directly to said exit. Steps shall not be permitted in any aisle or in any portion of the auditorium floor.

550. **Corridors — Passageways — Doors — Width Of.)** The width of corridors, passageways and doors shall be computed in the same manner as provided in Sections 526 and 527.

551. **Seats—Size—Location.)** There shall not be more than ten seats in any one row between aisles, nor more than six seats between an aisle and side wall. Seats shall not be less than thirty-two inches from back to back and shall not be less than twenty inches in width measured at the top of the seat back, and shall be secured firmly to the floor.

552. **Doors and Exits.)** In every building of Class IVc, there shall be provided at least two entrance doors. No entrance doors shall be less than four feet in width. If the rear of the building abuts upon an alley, there shall be provided not less than two emergency exits leading directly to the said alley. Wherever emergency exits pass over or under the stage floor level, they shall be enclosed with walls of masonry nine inches in thickness, or four-inch hollow tile, or of two-inch solid plaster, composed of iron studs and metal lath and plaster, and shall have floors and ceilings of slow-burning mill, or fireproof construction. If the side of the auditorium abuts upon a street or alley, such emergency exits shall be located as follows: one exit shall be located at a distance not greater than five feet from the proscenium wall or stage, and the other exit shall be located at a distance half way between the foyer and the stage wall. Exits by means of stairways or stairway fire escapes, equal in width to eighteen inches for each one hundred persons, shall be provided, and for fractional parts of one hundred, proportionate part of eighteen inches shall be added. No such exit shall be less than two feet six inches in width.

553. **Doors to Open Outward.)** All doors affording ingress or egress in buildings of Class IVc shall open outward, and no door shall be less than three feet wide. Such doors shall be so constructed that they may be easily opened from within.

554. **Walls Between Auditorium and Stage.)** Where the area of the stage exceeds 72 square feet, there shall be provided a proscenium wall of solid masonry of not less than nine inches in thickness, extending from ground to the roof. Where the stage area is less than 72 square feet its proscenium wall may be constructed of two-inch solid plaster walls, composed of metal studs and metal lath and plaster or three-inch hollow tile. In no case shall the underside of ceiling or roof over stage house behind proscenium wall be at a higher level than three feet over the highest point of main proscenium opening. And there shall be no trap doors or other openings in the stage floor.

555. **Curtain.)** (a) The main curtain in the opening of the proscenium wall shall be composed of long fibre asbestos twisted on brass wire and woven into a close cloth. The laps shall be sewed with two lines of brass and asbestos stitching, which laps shall not be less than one-inch wide. Said cloth shall be lapped at least four times around the top and around the bottom bars with at least three lines of the stitching above specified.

(b) The edge of the curtain shall be continuously reinforced by lapping and stitching and also with pieces of sheet metal for clips. The curtain shall be at least thirty inches wider and higher than the masonry opening, and shall have steel top and bottom bars of not less than two square inches in cross section which bars shall be connected by four three-sixteenth-inch steel cables.

(c) There shall be three-eighth-inch spanning cables with upper ends secured to steel brackets fastened to the wall and the lower ends sufficiently counter-weighted to keep the cables taut and where cables pass through the stage floor, the holes shall be metal bushed.

(d) The curtain shall have hard wood eyelets not over eighteen inches center to center, around the standing cables on both vertical edges, which eyelets shall be secured to the curtain by bent brass clips riveted to the curtain with double sheet metal reinforcing.

(e) There shall be steel lifting cables, one-half inch in diameter, at each end of the curtain and at intermediate points not over ten feet apart attached to drums on shafts located above the curtain.

(f) The operating machinery shall be built according to good mechanical engineering practice.

(g) There shall be emergency chains midway between the lifting cables, to hold the curtain which shall be equal in strength and efficiency to the lifting cables.

(h) There shall be steel guides of not less than three-eighth-inch metal on each side of the curtain from the stage floor to the level of the overhead sheaves. The metal guides shall lap the edges of the curtain not less than four inches. The curtain shall be incombustible in all its parts and its operating devices.

(i) The painting and the manner of tripping the curtain and the number of and the location of places for tripping shall be subject to the approval of the Chief Fire Prevention Engineer.

(j) A permit shall be obtained from the Department of Buildings for the erection of each such curtain. The Commissioner of Buildings shall inspect each such curtain semi-annually for which semi-annual inspection, a fee of $5.00 shall be charged.

556. **Other Openings in Stage Walls.)** Every other opening in the proscenium wall or in the other walls of the stage shall have self-closing incombustible doors.

557. **Structure Over Ceiling—Construction.)** A structure may be built over the ceiling or roof of any building used wholly or in part for the purposes of Class IVc, provided such space is not used for sleeping or living purposes. Girders or trusses supporting same shall be of steel protected by fireproofing as required in Section 839 and the entire ceiling shall be covered with incombustible material subject to the approval of the Commissioner of Buildings.

558. **Picture Machine Booth.)** The walls floor and ceiling of every moving picture booth or machine house shall be built of four-inch hollow tile or four-inch solid concrete, supported on iron beams or columns, the door of operating room to be metal clad and swing outwards. There shall be a metal smoke or flue pipe eighteen inches in diameter extending from ceiling to three feet above roof of machine house and terminating in the open air outside of building.

559. **Standpipes and Hose on Stage.)** Where the stage area exceeds seventy-two square feet and any scenery is used on stage, there shall be a standpipe system installed on said stage subject to the approval of the Chief Fire Prevention Engineer.

560. **Vent or Flue Pipe Over Stage.)** (a) When the stage exceeds seventy-two square feet in area and combustible scenery is used, one or more flue pipes of incombustible material and equivalent to one-twentieth of the area of the stage shall be built over the stage and shall extend eight feet above the highest point of roof.

(b) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

561. **Capacity—Certification for License.)** The Commissioner of Buildings shall determine the number of persons any room used for the purposes of Class IVc may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

562. **Lighting Service Requirement.)** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVc but gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVc and every outlet therefrom leading to the outside of the building, and all open courts, passageways, and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls or auditoriums used for the purposes of Class IVc provisions shall be made to furnish a light supplied by gas, above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is greater than three hundred, provisions shall be made to furnish a light supplied by electricity and on the same circuit as the corridor and vestibule lights, above if possible, otherwise closely adjoining every opening to an exit or an emergency exit from such hall or auditorium, in addition to the gas light in such location previously required.

563. **Lighting in Theaters—Test of Sufficient Light—Penalty.)** Every portion of a moving picture theater, including exits, courts and corridors, devoted to the use or accommodation of the public shall be so lighted by electric light during all exhibitions and until the entire audience has left the premises that a person with normal eyesight shall be able to read Snellen standard test type 40 at a distance of twenty feet; and type 30 at a distance of ten feet; normal eyesight meaning ability to read 20 at a distance of twenty feet in daylight. Cards showing types 20, 30, and 40 should be displayed in the corridor of every such theater together with a copy of this ordinance. Any person, firm or corporation that violates, neglects or refuses to comply with, or resists or opposes the enforcement of this section, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and shall be deemed guilty of a separate offense for every day on which such violations, neglect or refusal shall continue.

564. **Scenery Shall Be Stationary — Approval—Metal and Asbestos Scenery.)** All scenery on the stage shall be made stationary, and shall consist of not over two asbestos curtains, three stationary wings on each side and four stationary border drops. All scenery and stage paraphernalia shall be treated with a fire-retarding solution subject to the test and approval of the Chief Fire Prevention Engineer. Where all scenery is made of metal upon metal supports, metal frames, and metal attachments or where all scenery is of pure long fibre asbestos twisted on brass wire and woven into a close cloth with metal framings, metal supports and metal attachments, it shall not be considered as scenery within the meaning of the term as used in this chapter.

565. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

566. **Frontage Consents Required.)** No building of this class shall hereafter be constructed for, or converted to the use of said class, unless frontage consents are secured as required by the ordinances of the City of Chicago and filed with the Commissioner of Buildings.

CLASS IVd

567. **Class IVd Defined.)** In Class IVd shall be included every grand stand and every baseball, athletic and amusement park.

568. **Loads—Allowance for Live Loads.)** The floors and stairs of grand stands and bleacher stands, existing or hereafter built, shall be designed and constructed in such manner as to be capable of bearing in all their parts and supports, in addition to the weight of the floor construction, partitions and permanent fixtures, that may be set upon the same, a live load of not less than one hundred pounds for every square foot of surface of said floors, and a live load of not less than one hundred and fifty pounds for every square foot of the bearing surface of the stairs.

569. **Grandstands—Frame within Fire Limits—Grandstands Hereafter Constructed — Fireproof — Frontage — Consents.)** (a) Wooden grandstands or tiers of seats commonly known and described as grandstands now constructed or in the process of construction may be erected, repaired or enlarged within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure. All grandstands hereafter erected within the fire limits, except as hereinafter provided, shall be made of fireproof or unprotected steel construction. The enclosing walls, if enclosed, shall be made of fireproof or incombustible materials, but the seats may be made of wood. Grandstands outside the fire limits, or inside the fire limits where the seating capacity does not exceed five thousand persons, may be constructed of wood, but no part of any such structure shall be within less than sixty feet of any other building or structure. The braces, supports and the underside of all seats, including bleacher seats, shall be treated with a fire-retarding solution once a year before opening up the premises containing such stand to the public.

(b) Every person, firm or corporation desiring a permit for the construction of a grandstand, except in connection with such as are now in existence, shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of

the street or streets on each side of the block or square in which it is desired to erect such grandstand.

(c) The Commissioner of Buildings shall inspect or cause to be inspected all tiers of seats and grandstands each year before same are opened to the public for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee shall be charged for such annual inspection as follows:

Where the seating capacity is 5,000 or less the fee shall be $10.00.

Where the seating capacity is more than 5,000 the fee shall be $25.00.

570. **Width of Aisles and Exits—Number of Seats Between Aisles.)** (a) The width of aisles and exits in all grandstands contemplated in Section 567, hereafter constructed, shall in no case be less than 36 inches and such width shall be increased toward the exits which serve as regular entrances, such width being computed at the rate of eighteen inches per 100 seats or fractional part thereof in non-fireproof grandstands, and at the rate of twelve inches for each 100 seats or fractional part thereof in fireproof grandstands.

(b) The number of seats between aisles in any row shall not exceed twenty in non-fireproof grandstands, nor thirty in fireproof grandstands.

571. **Temporary Seating Structures.)** Temporary seating structures for shows and outdoor exhibitions and the observation of holidays and special occasions may be built of combustible material, providing they are built structurally strong enough to support a live load of one hundred pounds per square foot, and comply with the provisions of Class IVb in regard to means of exit, aisles and rows of seats; and provided, further, that a permit be secured from the Commissioner of Buildings, which shall in no case be issued by him until the party desiring to erect said temporary seating structure shall secure the written consent of a majority of the property owners or their duly authorized agents, on both sides of the street on which said temporary seating struction is to be located in the block between the two nearest intersecting streets. Any permit issued for any such temporary seating structure as hereinabove provided for in this section shall not entitle the person so receiving said permit to use said temporary seating structure for more than ten consecutive days from the first day on which it is so used; and any temporary seating structure provided for in this section shall be removed within ten days after the use of the same as provided for in this section, and if not so removed it shall be the duty of the Commissioner of Buildings to order the same to be removed or torn down by the Fire Commissioner at the expense of the owner thereof.

572. **Use of Roofs—Requirements.)** Wherever the roof of any building is used for any purposes whatever, except as a covering for the building, it shall be considered as a story of the building and subject to such restrictions of use and such requirements of construction as are provided for the building by the ordinances of the City of Chicago.

Amusement Parks.

573. **Frontage Consents Required.)** It shall hereafter be unlawful for any person, firm or corporation, to build, construct, establish, produce or carry on, any amusement within any ground, garden or enclosure of the kind commonly known and described as amusement parks, wherein shows of different classes are offered or presented by one or more concessionnaries, without first securing written frontage consents as required by the ordinances of the City of Chicago. Such frontage consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the construction of any building or structure connected in any way with such amusement or amusement park.

574. **Requirements.)** (a) Buildings erected after March 13, 1911 within an amusement park, located outside the fire limits, shall comply, except as herein otherwise specified, with the provisions of Class IVb.

(b) Buildings erected after March 13, 1911 within amusement parks located outside of the fire limits and not exceeding one story in height and which do not contain more than one balcony may be built with a self-supporting steel frame designed as required by this chapter. Such structures may be enclosed with metal lath covered with cement plaster, which plaster shall be not less than one and one-third inches thick, or such structures may be enclosed with galvanized iron. The roofs of such structures may be of ordinary construction supported on steel trusses and covered with a gravel or composition roof, approved by the Commissioner of Buildings.

(c) Every moving picture theatre hereafter built within an amusement park shall comply with the provisions of Class IVc.

575. **Open Space Between Buildings.)** There shall be an open and unobstructed space of not less than four feet between each and every frame building erected after March 13, 1911, in an amusement park, where the buildings do not exceed twenty feet in height, and of not less than six feet where the buildings are over twenty feet and less than thirty feet in height, and of not less than ten feet when the buildings are over thirty feet in height. Where brick or concrete or other fireproof walls of full seventeen inches in thickness are used between such buildings and where such buildings are built of slow-burning construction, these spaces shall not be required, but, in such cases, there shall be a space of ten feet in width at intervals of every two hundred feet.

576. **Roller Coaster Devices.)** No roller coaster, scenic railway, or other riding, sliding, or rolling device, shall be hereafter erected of a greater height from the ground than 55 feet. All such coasters, railways, riding or other devices shall be equipped with safety clutches. The cars, or any receptacles, which persons are permitted to occupy, or in which they are permitted to travel, ascend or descend, shall have hand rails of sufficient number and height to prevent people from being thrown therefrom, and of such character as shall be approved by the Commissioner of Buildings.

577. **Roller Coasters—Scenic Railways, Etc.—Permit Fee—Certificate of Test and Safety.)** (a) Before any roller coaster, scenic railway, water chute or other mechanical riding, sailing, sliding or swinging device is erected, either in existing or new amusement parks, a detailed plan shall be submitted to the Commissioner of Buildings, for his approval or rejection, and, if approved, a permit shall be procured by the person, firm or corporation desiring to erect such device. The permit fee shall be fifty dollars for each such device. Before such device is opened to the public each season, a certificate of inspection, signed by a competent engineer, approved by the Commissioner of Buildings, must be furnished, certifying to the practicability, strength and safety of such devices, and such device shall be examined by the Commissioner of Buildings or his employees upon completion and also each year before the opening up to the public.

(b) The Commissioner of Buildings shall inspect or cause to be inspected all buildings to be used for purposes of exhibition, amuse-

ment or entertainment which are attended by the public that are within or connected with an amusement park, each year before said buildings are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. The fee for such annual inspection shall be five dollars for each building so inspected.

(c.) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices, mechanisms and structures other than riding devices and other than buildings within an amusement park, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings; and the fee for such annual inspection shall be ten dollars for each device, mechanism and structure so inspected.

(d) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices operated by animals or by other motor power and all other riding, sliding, sailing, swinging or rolling devices situated on any lot or tract of land outside of the amusement park before said devices are open to the public. Where said devices are taken down, removed and reassembled or re-erected in another location, the Commissioner of Buildings shall inspect or cause said devices to be reinspected after each removal and before said devices are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee of five dollars shall be made for every such inspection or re-inspection.

578. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct, alter or operate any amusement park or any building or structure therein unless they comply with the ordinances of the city relative thereto.

ARTICLE VIII.

Class V.

579. **Class V Defined.)** In Class V shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical presentation, shall not be considered as public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IV as defined in this chapter.

Whenever words are used in the articles of this chapter which relate to the classification of Class V buildings into buildings in existence and buildings hereafter erected, such words (unless expressly shown to be intended otherwise) shall be understood as referring to the date July 18, 1905, at which time the original ordinance making such classification was passed by the city council.

580. **Must Comply with General and Special Provisions.)** In addition to the provisions of this article every building of Class V shall also comply with the general provisions of this chapter.

581. **City Officers Empowered to Enter Buildings.)** The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V, and any and all parts thereof, at any reasonable time and at any time when occupied by the public, in order to examine such buildings, to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

582. **City Officers Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Cass V, closed, where it is discovered that there is any violation of any of the provisions of the chapter, and keep same closed until such provisions are complied with.

583. **License—Mayor Shall Revoke.)** Upon a report to the Mayor by the Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, or the Superintendent of Police that any requirement of this chapter or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theatre or place of amusement so reported and cause the same to be closed.

Buildings of Class V Now in Existence.

584. **Buildings of Class V Now in Existence.)** The following provisions shall apply to Class V buildings in existence at the time of the passage of this ordinance:

585. **Walls—Outside—Must Comply with Requirements of Section 732.)** The outside walls of all such buildings in existence at the time of the passage of this ordinance, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more shall comply with the requirements of Section 732.

586. **Columns in Walls—Alterations.)** If iron or steel columns are introduced in the walls referred to in Section 585 the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Sections 838 and 839 of this chapter. All alterations in such existing buildings, to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fireproof construction or iron or steel construction covered with fireproof materials, as provided by this chapter.

587. **Other Classes Built in Conjunction with Class V—Doors for Openings Between Connecting Buildings.)** In all cases where existing buildings used wholly or in part for the purposes of Class V are built in conjunction with or as part of buildings devoted to the uses of other classes and where such buildings of the other classes, as specified in this ordinance, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V and the building connected therewith.

588. **Floor Levels—Limitations of.)** (a) Any audience room used for the purposes of Class V now in existence containing in the aggregate not more than five hundred seats, if in a fireproof building, may be maintained in any story thereof, but in such case there shall be at least two stairways to the ground, from the floor or floors on which each such room is located, each of which stairways shall be not less than four feet in width in the clear.

(b) In existing buildings of fireproof construction, having an audience room with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this ordinance. The main floor of any existing theatre of any kind of construction shall not be raised above its present elevation.

589. **Loads—Allowance for Live Loads in Construction of Floors of Class V.)** For all buildings of Class V all floors shall be designed and constructed in such manner as to be capable of supporting in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

590. **Stairways—Handrails—Entrances and Exits.)** (a) Stairways, affording egress from any room or rooms used for the purposes of Class V shall be equivalent in width to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches shall be added, but no such stairway shall be less than four feet wide in the clear, except as hereinafter provided in this section.

(b) All such stairways shall have hand railings on each side thereof and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs. No run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails with end newel posts at least 5½ feet high.

(c) Steps shall not have a greater rise than 8 inches, treads shall not be narrower than 10 inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

(d) In existing theatres every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theatre is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails, three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

(e) There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Every stairway leading to a box or boxes shall be independent of all other stairs or seats: and such stairway shall not be less than two feet eight inches wide in the clear, when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

(g) Every stairway on the stage side of the proscenium wall shall be not less than two feet six inches wide.

(h) Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theatre shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theatre shall be issued.

591. **Floors and Exits.)** Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

592. **Seats in Rows Between Aisles.)** (a) Not more than ten seats in any row shall be permitted between aisles in any gallery. On the main floor and balcony not more than eleven seats shall be permitted between aisles; except in rows of seats which are within twenty feet from the exits, in which case thirteen seats shall be permitted between aisles.

(b) Seats shall be not less than twenty inches in width measured at the top of the seat backs. Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

(c) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, except that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other. And except that a bank of seats abutting boxes or walls on main floor, balcony, and gallery, of not over five seats in a row, shall be required to abut upon one aisle only.

(d) The number of banks of seats on the main floor shall not exceed fifteen unless an intervening or cross aisle is provided between each fifteen banks of seats or unless a direct exit is provided for each aisle.

(e) The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or unless a direct exit be provided for each aisle.

593. **Limits of Vertical Rise and Requirement for Tunnels in Cross Aisles—Openings in Foyer Wall.)** (a) There shall be no more than twelve feet rise measured vertically in any aisles in any floor or in any balcony or in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

(b) There shall be no openings in the foyer wall between the foyer and theatre proper other than the exit openings.

594. **Main Floor—Balcony and Gallery—Designation of.)** (a) The lower floor of all theatres shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be

designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

595. **Aisles—Width of—Shall Lead Direct to Exit—Steps in Aisles.)** (a) The minimum width of aisles with diverging sides in any room used for the purposes of Class V shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

(b) The minimum width of aisles with parallel sides shall be three feet.

(c) Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

(d) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be greater than 8 inches, and no tread shall be less than 10 inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

596. **Corridors, Passageways, Hallways and Doors—Width of.)** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall lead directly to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not have locks or catches of any kind whatever.

597. **Doors—Entrance.)** (a) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each one hundred permanent seats in the audience room and in addition thereto a proportionate part of twenty inches for the fractional part of one hundred seats shall be added.

(b) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, window, exit, hallway or corridor where none exists.

598. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

599. **Emergency Exits — Width — Emergency Stairs—Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each floor, balcony and gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency stairways shall be made of iron, steel, or other incombustible materials. Such emergency exits shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

(c) If said emergency exits lead outside the building, the opening leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when they open automatically from the interior, without resistance, and when used or open will automatically fasten, securely, flat against the wall, so as not to obstruct the passage on the outside; all such automatic devices or attachments to said doors or shutters shall be subject to the approval of the Commissioner of Buildings and the Chief Fire Prevention Engineer.

(d) Whenever any such emergency stairway passes over an exit door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of

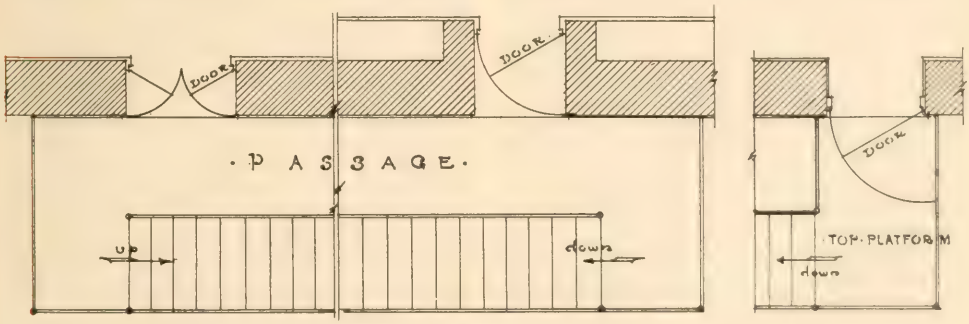

Fig. 3.
EMERGENCY EXITS.
Section 599.

Suggestion how to swing doors, so as not to obstruct passageway.

the ground to a street, alley or yard opening into an alley, or street, without entering into or passing through or over any building unless by a fireproof passage at least four feet wide and seven feet high on the court or ground level.

(g) All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

600. **Proscenium Wall—Curtain—Requirements for Other Openings in Proscenium Wall.)** (a) There shall be in every theatre a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and shall be in constant use as the regular curtain and act drop.

(b) No combustible material other than painted decorations shall be applied to the audience side of such curtains.

(c) Plans for such curtains shall be approved by the Commissioner of Buildings and a permit obtained previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, for which inspection a fee of five dollars shall be charged.

(d) All other openings in such proscenium wall shall have iron doors, frames and thresholds.

601. **Stage — Construction of — Framing for Scenery.)** The framing for the floor of every stage shall be of iron, steel, or reinforced concrete. The stage floor may be of wood not less than one and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief Fire Prevention Engineer. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports, shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

602. **Vestibule for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery and auditorium against draughts of air.

603. **Vents—Flue Pipes, Size of—Dampers—Switches for Dampers.)** (a) One or more vents, or flue pipes, of metal construction or other incombustible material, suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a fused cord and by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them fail to operate. Such stations shall be located in such places on the stage as may be determined by the Chief Fire Prevention Engineer, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

604. **Automatic Sprinklers.)** (a) A system of automatic sprinklers subject to the approval of the Chief Fire Prevention Engineer, shall be provided and installed in every theatre.

(b) Where water for such system of automatic sprinklers is supplied from a tank, the supports and installation of such tank or tanks shall be subject to the approval of the Commissioner of Buildings.

605. **Lighting Requirements — Buildings Class V Now in Existence.)** Lighting of every building of Class V, whether now in existence or hereafter erected, shall comply with the requirements for buildings of Class V hereafted erected.

606. **Capacity — Certificate for License.)** The Commissioner of Buildings shall determine the number of persons which every room used for the purpose of Class V may accommodate according to the provisions of this chapter and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

607. **Theatres in Frame Buildings Prohibited.)** No frame building, or part thereof, within the city, shall be used as a moving picture, vaudeville or other theatre; provided, that nothing herein contained shall be held to apply to any frame building existing at the time of the passage of this ordinance and in which a moving picture, vaudeville or other theatre is being maintained at the time of the passage of this ordinance, where all the scenery, if any, used in connection with such moving picture, vaudeville or other theatre, is constructed of either sheet-metal or asbestos, and where the amount of exit space for such theatre is at least fifty (50) inches for each one hundred (100) seats therein contained, and where there is no living apartment of any kind used, maintained or occupied as such in any part of said building.

BUILDINGS OF CLASS V HEREAFTER ERECTED.

608. **Buildings of Class V Hereafter Erected.)** The following provisions shall apply to buildings of class V hereafter erected and used wholly or in part for such purposes:

609. **Construction—Walls—Outside Walls—Structures.)** All buildings of Class V hereafter erected shall be built of fireproof construction.

610. **Frontage — Open Spaces — Fireproof Passageways.)** (a) All buildings hereafter erected used wholly or in part for the purposes of Class V shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten (10) feet in width.

(b) The audience room of every such building used for the purposes of Class V shall have either a public thoroughfare or an open space not less than ten feet wide extending from the lowest first floor level to the sky, on each of the two sides other than the proscenium and the foyer. Exit doors shall open onto such public thoroughfare or the bottom of such open space from

the respective sides of the stage and of the main floor of the audience room, and onto balconies or platforms built in such public thoroughfare or open space at both the highest and the lowest floor levels of each and every balcony and gallery and the doors opening into such public thoroughfare or open space from any balcony or gallery or from the main floor shall comply with all the requirements prescribed in Section 618 of this chapter.

Provided, however, where such building has a seating capacity of not to exceed 1,000 persons, and in which the seats for the entire audience are located upon the main floor, and where no part of the main floor is higher than four (4) feet above the inside sidewalk grade of the street opposite the main entrance to such building, and where every part of every building connecting thereto or built in conjunction therewith is of fireproof construction, the provisions for open spaces alongside audience room as contained in Section 544 applicable to buildings of Class IVc where the entire audience is seated on the ground level shall govern with respect to open spaces, and the provisions of Section 545 shall govern with respect to main floor aisles and direct exits from same.

Provided further that two theatres are erected simultaneously in the same building or in adjoining buildings under the same ownership, and where the aggregate seating capacity of both theater audience rooms taken together does not exceed a total of 2,500 persons, and where said building or adjoining buildings have a frontage upon three public thoroughfares, the said audience rooms may have in common an open space not less than ten feet in width in every part thereof from the line of the proscenium wall along and directly adjacent to each audience room to the public street upon which such building or buildings face. Such open space shall be clear and unobstructed from the bottom thereof to the sky, and may be considered the equivalent of an open space for each audience room as required by this section.

(c) All such balconies or platforms as are required by this section shall be connected with stairway fire escapes leading to the street level or to the bottom of such open space and in the latter case they shall have their bottom run toward the public thoroughfare and such balconies or platforms and such fire escapes shall comply with all the requirements prescribed in Sections 881, 882 and 885 of this chapter. Every such open space, if it does not open into a public thoroughfare shall communicate with the public thoroughfare at the front side of the theatre by a fireproof passageway leading from the bottom level of such open space to the sidewalk level. Where there is a public thoroughfare behind the stage every such open space shall also communicate with such public thoroughfare by a fireproof passageway leading from the bottom level of such open space to the level of the public thoroughfare behind the stage, and passing under the stage.

(d) The walls of a fireproof passageway shall not be less than four inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions of this chapter relating thereto.

(e) Radiators for warming passageways shall be in recesses sufficient in depth to prevent them from obstructing the passageway.

(f) There shall be no steps or risers in fireproof passageways, but where necessary, inclined floors of the full width of the fireproof passageway may be built; the incline of the floor shall not exceed two and one-half inches in height per foot measured horizontally, and no such incline shall be less than ten feet in length. No fireproof passageway shall be less than ten feet wide and eight feet high in any part thereof except at doors, and these door openings shall be not less than eight feet wide and seven feet high.

(g) If the principal entrance corridor of a theatre is at one side and approximately at right angles to the central axis of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage, on said center axis of the stage and the audience room and at a point midway between such seat and the wall opposite the proscenium wall.

611. **Buildings of Other Classes Built in Conjunction with Class V.)** If buildings used wholly or in part for purposes of Class V, are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built of fireproof construction.

612. **Floor Levels — Live Loads.)** (a) The floor level of the highest bank of seats on the main floor shall not be more than three feet above the sidewalk level and the floor level of the lowest bank of seats on said floor shall not be more than eight feet below the sidewalk level.

(b) All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

613. **Stairways—Handrails—Entrances and Exits.)** (a) Stairways affording ingress to or egress from any room used for the purposes of Class V shall be in width equivalent to twenty inches for each one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairways be less than four feet in the clear, except as hereinafter provided.

(b) All such stairways shall have hand rails on each side thereof, and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

(c) Steps shall not have a greater rise than eight inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

(d) Every balcony and gallery shall have one or more separate and distinct exits and stairways to the sidewalk level. All gallery stairways shall lead to the top gallery and there shall be doors in same at each floor for exit purposes only. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the buildings, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

(e) There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway

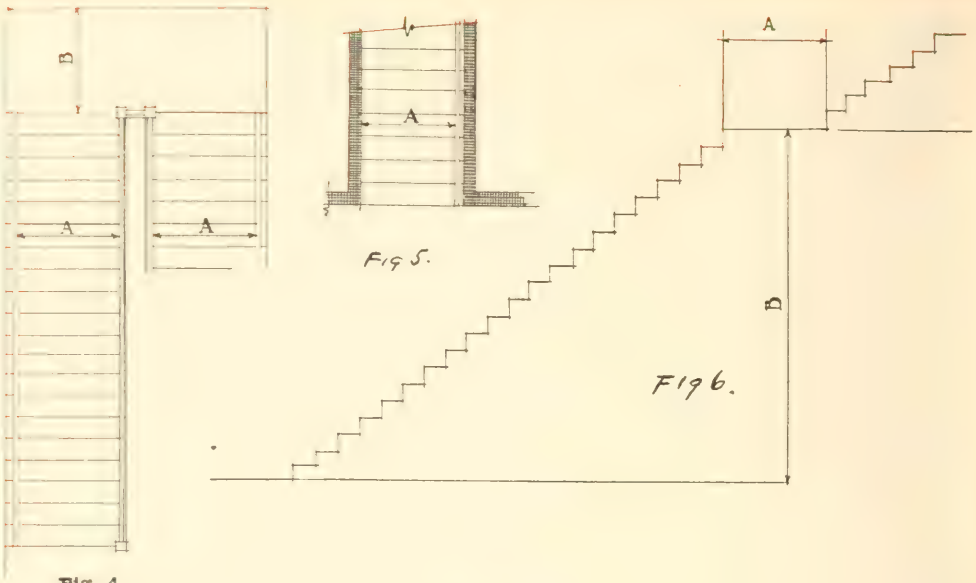

Fig. 4.

STAIRWAYS.

Sections 551, 656, 664, 667, 701, 878, 880 and others.

Fig. 4 (A) Shows measurement of stairways where hand rails are required on each side.
(B) Shows measurement of landing.

Fig. 5. Measurement of sfairway where hand rail is required on one side only.

Fig. 6 (A) Landing.
(B) Stairways shall not ascend to an unlimited height (B) without a landing (A), and (A) shall not be less in width and length than (A) Fig. 4 measurement of stairs.

Fig. 7. Fig. 8.

Fig. 7. Over 7′ 0″ (for exceptions see ordinance) wide stairways (C) shall have double intermediate hand rails. In plan (Fig. Sec. AA).
(B) Measurement of stairs where double intermediate hand rails occur.
(C) Measurement of stairs where double intermediate hand rails do not occur, as in general case, Fig. 4 (A).

Fig. 8. Newel post 5½′ 0″ high (A) required for stairs as referred to in Fig. 8.

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or exit. Such stairway may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five persons for whom seating capacity is provided, or major portion thereof, in such box or boxes there shall be an additional five inches in width of such stairway.

(g) All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

614. **Floors at Exits — Seating.)** (a) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

(b) There shall not be more than ten seats in any one row between aisles.

(c) Seats shall be not less than twenty inches in width, measured at the top of the seat backs.

(d) Rows of seats shall not be less than two feet ten inches from back to back.

(e) No bank of seats shall have a greater rise than twenty inches. A bank of seats abutting boxes or wall on main floor, balcony or gallery of not over five seats in a row, shall be required to abut upon one aisle only.

(f) Seats in loges and boxes shall be limited in the ratio of one seat for every six hundred and eighty square inches of floor area in such loge or box.

(g) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle on the other side.

(h) The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" and "galleries" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

615. **Limit of Rise in Floor — Opening in Foyer Wall.)** (a) There shall be no more than eleven feet rise, measured vertically, in any main floor or in any gallery or in any balcony without a direct exit by tunnel or otherwise, to a corridor with free opening onto the gallery stairs or other direct discharge to the street or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than four feet wide in the clear.

(b) There shall be no openings in the foyer wall between the foyer and theatre proper other than the exit openings.

616. **Main Floor—Balcony and Gallery—Designation of.)** (a) The lower floor of

every theatre shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

617. **Width of Aisles—Exit from Aisles—Steps in Aisles.)** (a) The minimum width of aisles with divergent sides in any room used for the purpose of Class V shall be two feet eight inches at the end nearest the stage and not less than three feet at the other end. The minimum width of aisles with parallel sides shall be three feet.

(b) Every aisle shall lead directly to an exit. An exit located at the end of any aisle and at right angles thereto shall be considered a direct exit.

(c) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than eight inches in height, and no tread shall be less than ten inches in width, and wherever the rise from bank to bank of seats is less than five inches, the floor of the aisle shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated but shall be grouped together, and a light shall be installed so that every place where there are steps in such aisles or corridors shall be clearly lighted.

618. **Corridors — Passageways — Hallways and Doors—Width of—Leading from Toilet Rooms and Cloak Rooms to Outer Exits of the Building—Width of Entrance Doors.)** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, provided, however, that no corridor shall be less than five feet in width and no doorway less than three feet wide, except as otherwise herein provided.

(b) Every toilet room, retiring room, smoking room, cloak room, check room or private office which is accessible from any corridor, passageway, hallway or stairway leading from any floor, balcony or gallery shall, in addition to the entrance thereto, have an exit arranged in such manner as to permit of direct passage through such room or office, without returning, to an outer exit of the building. Corridors, passageways, hallways and stairways shall be at least four feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

(c) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each 100 permanent seats in the audience room, and in addition thereto a proportionate part of twenty inches for the fraction part of 100 seats remaining shall be added.

619. **Emergency Exits and Stairs—Width of—Emergency Stairs—Construction of, Requirements—Shall Not be Obstructed—Emergency Exits Inside Walls of Buildings—Doors to Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each floor, balcony or gallery and shall be of the same aggregate width as that provided for the main exits, and shall be not less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

(c) If such emergency exits lead outside the building, the openings leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall, and outer shutters shall not be permitted.

(d) Whenever such emergency stairway passes above an exit door, window or other opening, such stairway shall be completely enclosed by iron, steel or other incombustible material for a space of five feet greater in width than such opening, and such openings below such emergency stairway shall be equipped with approved metal frames and doors or metal sash and wired glass.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or obstructions of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street, without entering into or passing through or over any buildings unless by a four-foot wide fireproof passage on the court or ground level.

(g) All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward.

620. **Proscenium Wall Curtain and Requirements — Permit for and Inspection of Curtain.)** (a) There shall be a solid masonry wall of the same construction and thickness as is required in the outside walls of the building in which such theatre is located between the auditorium and the stage.

(b) The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by hydraulic power, and shall be in constant use as the regular curtain and act drop.

(c) The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be from the stage level and the other shall be designated by the Commissioner of Buildings.

(d) The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-heat-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees Fahrenheit on the stage side for fifteen minutes without heating the opposite side to a higher temperature than three hundred and fifty degrees Fahrenheit.

(e) All metal work with the exception of the frame shall be covered with such non-heat-conducting substances on the stage side.

(f) The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channel or in the engaging edge of the curtain shall be less than three-eighths of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

(g) The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship, shall be ac-

cording to the best modern engineering practice. The stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

(h) No part of a curtain or of the curtain guides shall be supported by or fastened by any combustible material.

(i) The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist either inward or outward a pressure of five pounds for each and every square foot of the curtain.

(j) No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

(k) Plans for every such curtain shall be approved by the Commissioner of Buildings and a permit obtained therefor previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, and for each such inspection a fee of five dollars shall be charged.

(l) Every other opening in such proscenium wall shall have self-closing regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

621. **Stage—Construction of—Framing for Scenery.)** The framing for the floor of every stage shall be of iron, steel or reinforced concrete. The stage floor may be of wood not less than two and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief of Fire Prevention and Public Safety. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and permanent cables and their supports shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

622. **Vestibules for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

623. **Structures Over Ceiling—Construction.)** If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall be fireproofed in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

624. **Vents—Size of—Flue Pipes—Dampers—Switches for Dampers.)** (a) One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof materials, with an air space between, and no fuses shall be exposed to the air between the switchboards.

625. **Standpipes—Automatic Sprinklers—Tanks for Water.)** (a) A system of standpipes and of automatic sprinklers subject to the approval of the Chief Fire Prevention Engineer, shall be provided and installed in every theater.

(b) The supports and installation of all tanks used to supply water to such system of standpipes and such automatic sprinkler system shall be subject to the approval of the Commissioner of Buildings.

626. **Ice Making Machinery—Prohibition of.)** It shall be unlawful to install any machinery or compressors of any description to be used in conjunction with ammonia in the manufacture of artificial ice in the auditorium or stage parts of any building of Class V, and it shall be unlawful to convey ammonia or to install any piping for the conveying of ammonia into any building of Class V for the purpose of manufacturing artificial ice from any machinery or compressors situated outside of any building of Class V.

627. **Lighting Service Requirements**—Gas or electricity or both may be used for illuminating purposes in buildings of Class V hereafter erected. Gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of this class and every outlet therefrom leading to the outside of the building and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent circuit or service and shall be controlled separately and exclusively by a switch or shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of this class, provisions shall be made to furnish a light supplied by gas and a light supplied by electricity above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium.

The light furnished by gas as required by the provisions of this section above or adjacent to an exit or exits may be omitted if in lieu thereof a light supplied by electricity furnished by storage battery system or by a motor generator and service battery system is installed. Said lights, motor generator and battery system shall be approved by the Commissioner of Gas and Electricity, and shall be installed and operated in compliance with the rules of the Department of Gas and Electricity.

Amendment of July 15, 1924, not signed by Mayor.

628. **Dressing Room Partitions.)** Partitions forming dressing rooms shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

629. **Capacity—Certificate for License.)** (a) The Commissioner of Buildings shall determine the number of persons which each room used for the purpose of Class V may accommodate according to the provisions of this chapter, and shall certify the same

to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) Before a license shall be issued for the operation of a buiding of Class V as a theater the Commissioner of Buildings shall first certify, in writing, that such theatre complies with the provisions of this chapter in every respect.

630. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains,

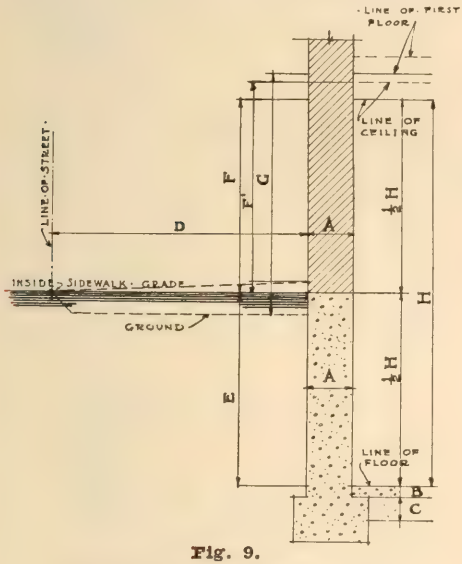

Fig. 9.

DEFINITION OF BASEMENT, ETC.
Sec. 634

(H) Height of basement (floor to ceiling).
(D) Distance from street line nearest the building.
(E) Distance below sidewalk grade.
(F) Distance above sidewalk grade.

Explanation:

Basement is a story partly but not more than ½ below (½ H) the level of the inside sidewalk grade. If floor of basement is less than 2 ft. (E) below such grade, or if ceiling of such basement is more than 7′ 6″ (F) above said grade, said story shall be classed as first story.

(F) For every foot of (D) F may be raised not more than 1-3″, as at (F′).

(G) Equals distance from ground to line of first floor.

Ex. for yard ground levels or walks or other improvements for a distance of 12′ 0″ at every point from all outside walls. (G) shall not be lower than 8′ 3″.

Sec. 659

(A) Not to be less than 12″. (See Sec. 506 for exceptions).
(B) 3″ thickness of floor required.
(C) 6″ sand or cinders required.

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borders and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

(b) "Movable Scenery" shall include all scenery, drop curtains, borders, and wings which are made movable for the purpose of changing an entire set of scenery and substituting another set during or between the various stage acts.

631. **Changing from Class IV to Class V.)** Whenever an existing Class IV theatre is changed into a Class V theatre, the same shall be made to comply with all of the provisions for Class V theatres hereafter erected.

ARTICLE IX.
Class VI.

632. **Class VI Defined.)** In Class VI shall be included every tenement and apartment house or building or portion thereof, which is used or intended to be used as a home or residence for two or more families living in separate apartments.

633. **Requirements—General.)** Every building of Class VI shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

634. **Definition of "Existing Tenement,,—"New Tenement"—"Apartment"—"Yard"—"Court"—"Shaft"—"Public Hall"—"Stair Hall"—"Basement"—"Cellar"—"Story"—"Solid Masonry".)** (a) "New Tenement house" shall include every tenement, flat and apartment house erected after December 17, 1902, and every tenement house which shall hereafter be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use. "Existing tenement house" shall be construed to mean a flat or apartment house built prior to December 17, 1902.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building. If the floor of such basement is less than two feet (2 ft.) below such grade or if the ceiling of such basement is more than seven feet, six inches (7 ft. 6 in.) above said grade, said story shall be classed as the first story of the building in which it occurs. Provided, however, that the ceiling height may be raised above the height of seven feet, six inches (7 ft. 6 in.) heretofore given, not more than one-third of an inch for every foot of such distance said building is set back from the street line of the street nearest the building, but in no case shall any rise of ceiling be allowed for any distance beyond thirty feet (30 ft.) said building may be set back from the line of the street nearest the building, and in such cases all rises in the basement ceiling shall be computed according to the distance between the street line and the outside wall of the building nearest to said street line. Provided further, that the yard or ground level, or walks, or other improvements thereon for a distance of twelve feet (12 ft.) at every point from all outside walls of said building shall not be lower than eight feet three inches (8 ft. 3 in.) below the floor level of the first story of said building

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building.

Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this chapter.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

635. **Where Sections of This Article Conflict With Other Sections.** In cases of direct conflict with the provisions of other sections of this ordinance relating to other classes, or of sections in other articles of this chapter, the provisions of the sections in this article relating to Class VI shall govern in respect to tenement houses.

636. **Changes or Alterations—Permits.)** Every new tenement house and every change or alteration in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Commissioner of Buildings. Such permit shall be issued only upon an application by the person, firm or corporation for whom the building is to be erected or altered, and after approval of the plans and specifications for such tenement house or for such changes or alterations by the Commissioner of Health whenever such approval is required by the ordinances of the City of Chicago.

637. **New Tenement House—When to be Occupied.)** (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the Commissioner of Health that said building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the Commissioner of Buildings of a certificate that the said building conforms to the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representatives shall be entitled, upon application in writing, to an inspection of the same by the Commissioner of Buildings, and if the work to that point is in compliance with the provisions regarding the size of shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representatives shall be entitled to an inspection from the Commissioner of Buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, he shall be entitled to a certificate stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the Commissioner of Buildings and shall be vacated upon such notice and shall not again

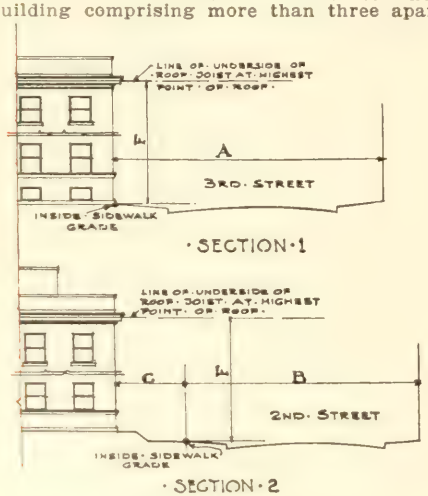

Fig. 10.

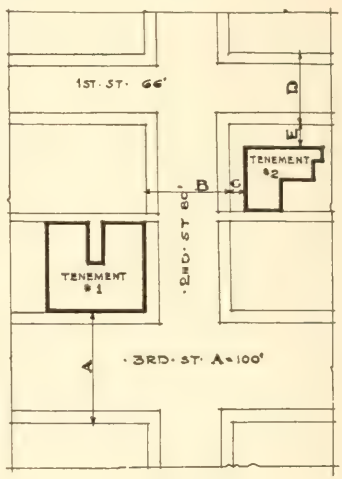

Fig. 11.

SECTION 640 a b.

Height of Tenement House; How Measured.

A—width of widest street (in this case 3rd St.) on which tenement house No. 1 abuts.

B—width of widest street (in this case 2nd St.) on which tenement house No. 2 abuts.

C—distance tenement house No. 2 sets back from 2nd St.

D—width of 1st St., other street on which tenement house No. 2 abuts.

E—distance tenement house No. 2 sets back from 1st St.

F—allowable height, which in this illustration is measured as shown by the perpendicular distance from the inside sidewalk grade of the street nearest the building, to the highest point of the external bearing walls. For exceptions, where elevator enclosures and cornices or bulkheads are used, see section 640 b, last paragraph.

Explanation:

F—tenement house No. 1 shall not exceed 1½ A.

F—tenement house No. 2 shall not exceed 1½ (B+C) unless 1½ (D+E) is greater than 1½ (B+C). then F shall not exceed 1½ (D+E).

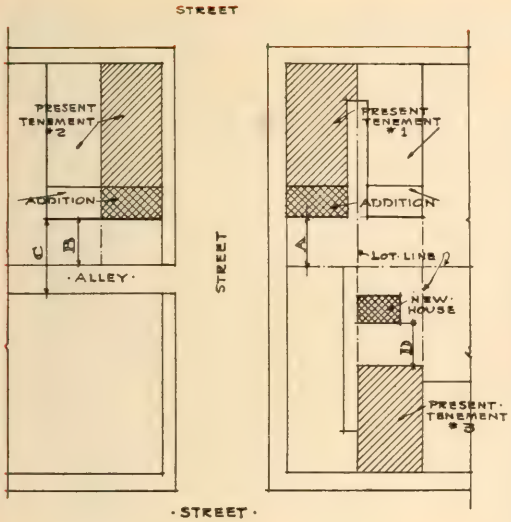

Fig. 12.

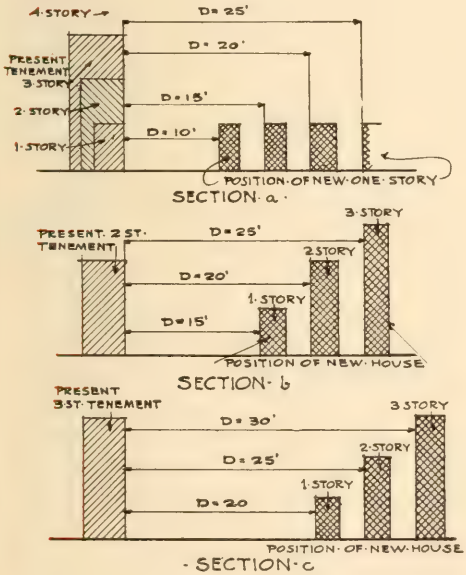

Fig. 13.

SECTION 641

A—distance from rear line of addition, to present tenement house No. 1, to rear line of lot.

B—distance from rear line of addition, to present tenement house No. 2, to rear line of lot, abutting public alley.

C—distance from rear line of addition, to present tenement house No. 2, to opposite side of such alley.

D—distance from present tenement house No. 3, standing on an inner lot, to new building.

Explanation:

A shall not be less than 10 ft. either by addition to, or diminishing present tenement house No. 1.

If B is less than 10 ft., then C must not be less than 16 ft. Sections a, b, c, are explanatory diagrams of different cases of required distances D, between tenement house No. 3 and new house. Exception to this rule is stated in last paragraph of Section 641.

be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

638. **Plat to be Filed.)** At the time of applying for a permit for the erection of, alteration of, addition to or moving of a tenement house or for the erection, alteration, adding to or moving of any building upon a lot upon which a tenement house stands, the applicant shall submit to the Commissioner of Buildings a plat of the lot, showing the dimensions of the same and the position to be occupied by the proposed building or by the building to be altered or added to or by the building to be moved thereon, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

639. **Corner Lot Defined—Frontages.)** By "corner lot" is meant a lot situated at the junction of two streets or of a street and a public alley at least sixteen feet wide, provided that if such alley be less than sixteen feet wide, and the lot be estimated on a line sixteen feet from the opposite side of the alley, such lot may be considered a corner lot. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots. Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone, and not alley frontage shall be considered in determining such lesser frontage.

640. **Height—How Measured.)** (a) The height of a new tenement house shall not exceed by more than one-half the platted width of the widest street on which it abuts, and no existing tenement house shall be increased beyond such height.

(b) Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation. Such height shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls and shall not include any cornice or bulkhead less than eight feet high or any elevator enclosure less than sixteen feet high. Where such street grade varies, the mean or average grade thereof opposite such building shall be the data from which such height is measured.

641 **Distance Between Buildings.)** No existing tenement house shall hereafter be enlarged or its lot be diminished, so that the rear line of any building on such lot approaches nearer than ten feet to the rear line of the lot, unless the rear of the lot upon which it stands, abuts upon a public alley, in which case the rear line of such building shall be not less than sixteen feet from the opposite side of such alley. Where a tenement house, now existing or hereafter erected, stands upon a lot other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories, and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one, in the height of the highest building on such lot; Provided, that a one-story building without basement, and not used for habitation, may be placed on the rear of a lot containing a tenement house, if a minimum distance of ten feet is maintained between every point of such building and the tenement house.

642. **Percentage of Area Allowed to be**

Covered.) No existing tenement house shall hereafter be enlarged nor its lot be diminished, nor other buildings be placed on its lot, nor a tenement house be moved on a lot on which there is an existing building, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings, than the following proportions, respectively: No new tenement house alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot, provided that in the case of a fireproof building, in which the windows of every habitable room open directly on a street, the portion of the lot covered may be ninety per centum of the area of said lot, subject to the requirement that a ten foot space must be left above the first story opposite the lesser frontage; or more than ninety per centum of the area of such corner lot if such corner lot is bounded on at least three sides by streets or alleys; or more than seventy-five per centum of the area of any other lot, except that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied. Provided, however, that in case of a lot, triangular or irregular in shape bounded on two or more sides by a street and having a number of lineal feet street frontage exceeding one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot which may be covered.

643. **Must Have Alley or Yard in Rear—Size of Yard Increased.)** At the rear of every lot containing a tenement house, there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law, unless the rear of such lot abuts upon a public alley at least ten feet wide, in which case the rear line of such building shall be not less than 16 feet from the opposite side of such alley; every part of such yard shall be directly accessible from every other part thereof; such yard shall have an area of at least eight per centum of the superficial area of the lot on corner lots except as otherwise provided in this section; and on other lots, such yards shall have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in height of the tenement house situated thereon.

644. **Courts — Inner — Outer — Lot Line.)** (a) "Inner courts" of all new tenement houses as defined in Section 634 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Courts— Height of	Least width in feet.	Least area in square feet.
1 story	6	100
2 stories	6	120
3 stories	8	160
4 stories	8	160
5 stories	12	260
6 stories	16	400
7 stories	20	625
8 stories or more.	24	840

(b) The height of a court shall be the number of stories having habitable rooms with windows in its walls.

(c) "Outer courts" and "lot line courts" of all new tenement houses as defined in Section 634 of this chapter shall have minimum widths at every point equal to one-half of the minimum widths required by this section, and lot line courts shall have minimum areas equal to one-half of the minimum areas required herein for "inner courts." If an outer court or lot line court has windows on opposite sides, its minimum width shall conform to the width given in the table.

(d) The minimum widths hereinbefore specified for outer courts and the minimum widths and areas specified for lot line courts are to be provided irrespective of the presence of or dimensions of courts on other premises bounded by the same lot line.

(e) Every "inner court" and every "lot line court" of every new tenement shall be connected directly with a street, alley, yard, or outer court by an opening extending from grade at the building to a height of at least fifteen feet, and kept unobstructed save by an openwork grill or gate, such opening to be at least two feet wide for an inner court and one foot wide for a lot line court. In case of a three-story tenement on a lot twenty-five feet or less in width, a continuous lot line passage open to the sky, and six inches in width, shall be accepted for the opening specified above as one foot wide for a lot line court. If such inner court or lot line court starts from any point above finished grade at building, such starting point shall be considered as grade for purpose of determining the location of the opening to outer air herein specified.

(f) In case of a three-story tenement on a lot of twenty-five feet or less in width a continuous lot line passage open to the sky, and at least three feet wide, shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a). In case of a three-story tenement on a lot thirty feet or less but more than 25 feet in width, a continuous lot line passage open to the sky, and at least three feet six inches wide shall be acceptd in lieu of a lot line court or outer court hereinbefore specified in Paragarph (a).

(g) In case of a two-story tenement on a lot twenty-five feet or less in width, a lot line court having an area of at least fifty square feet shall be accepted in lieu of a lot line court heretofore specified in Paragraph (a) of this section, and in case of a three-story tenement on a lot of twenty-five feet or less in width. a lot line court having an area of at least sixty square feet shall be accepted in lieu of a lot line court hereinbefore specified and required by Paragraph (a) of this section.

(h) In case of two or three-story tenement buildings on lots twenty-five feet or less in width, where there is only one apartment on each story containing not more than four rooms in such apartment, the light courts hereinbefore specified in Paragraph (a) may be omitted, provided there is a continuous passageway open to the sky and not less than three feet wide on one side of said building.

645. **Vent Shafts—Area Of.)** (a) "Vent shafts" of all new tenement houses, as defined in Section 634 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Height of Vent shafts	Least width in feet	Least area in square feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 stories or more.	8	120

(b) Every such vent shaft in every new tenement house more than two stories high, shall be connected directly with a street, alley, yard or court by one or more hori-

zontal ducts or intakes at a level not lower than the finished grade of building nor higher than second story floor; the total area of such ducts to be not less than three per cent of the area of such vent shaft, and no single duct to be of less area than one hundred square inches; such total and individual duct area shall be net over and above all obstructions.

646. **Stair Hall and Shaft—Well-Hole Dimensions.)** (a) Every public stair hall in every new tenement house shall, for each story, have a window of an area of at least twelve square feet, opening directly on a street, alley, yard or court; or on a shaft of minimum area, as hereinafter provided; or shall have an unobstructed vertical well-hole of the following minimum area at each floor line above the first, and, directly over such well-hole, there shall be a skylight of twice the following minimum area:

Building— Height of	Least area in square feet of stair shaft or well hole.
2 stories—if there is more than one apartment on a floor	8
3 stories—if there is more than one apartment on a floor	13
4 stories	19
5 stories	25
6 stories or more	38

(b) Such window, if any, shall be so placed that light may pass directly to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance. In any such public hall, recesses or returns, the length of which does not exceed twice the width of the hall, will be permitted, without an additional window, but, otherwise, each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

(c) Skylights shall be ventilating skylights and shall have over them a wire netting mounted on wire frame and 6-inch iron legs, of wire not lighter than No. 12 and with mesh not coarser than one inch by one inch, unless constructed of wired glass or prismatic light glass.

647. **Rooms—Size and Height Of—Attic Rooms.)** (a) In every new tenement house, all habitable rooms shall be of the following minimum sizes:

(b) In each apartment, there shall be at least one room containing not less than one hundred twenty square feet of floor area, and every other room shall contain at least eighty square feet of floor area, provided, however, that in the case of a room having a window not less than eighteen feet in area opening upon a public street, the floor area need not be greater than seventy feet. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling; provided, however, an attic room need be eight feet six inches high in but one-half of its area, in case there are not less than 750 cubic feet of air space therein.

648. **Alcoves and Alcove Rooms.)** (a) For the purpose of buildings of Classes III and IV, an alcove shall be defined as a recess connected with or at the side of a larger room. The floor of such an alcove shall be counted as a part of the floor area and its cubic contents as a part of the cubic contents of the room with which it is connected.

(b) In every new tenement house every alcove shall be deemed a separate room for all purposes within the meaning of this chapter, except an alcove that has a floor area of not to exceed thirty-five square feet and that has an unobstructed opening, equal in area to twenty per centum of its entire wall surface, into an adjoining habitable room; provided that in constructing additional habitable rooms by raising or altering existing one story dwellings, the limitation of the floor area of an alcove may be disregarded, provided such alcove has an unobstructed opening, equal to the floor area of such alcove, into an adjoining habitable room.

(c) This section shall not be construed as forbidding the erection of pilasters or other decorative effects projecting not more than eighteen inches from the plane of the wall of a habitable room.

(d) No part of any room in a tenement house shall be enclosed or sub-divided at any time, wholly or in part, by a curtain, portiere, fixed or movable partition or other contrivances or device, unless each part of the room so enclosed or sub-divided shall contain a separate window as herein required, and shall have a floor area of not less than 80 square feet as herein required for habitable rooms, except as heretofore provided in this section.

649. **Air—Quantity of for Each Person.)** No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

650. **Habitable Rooms — Bath Rooms — Pantries—Requirement as to Ventilation and Lighting.)** (a) In every new tenement house every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than even feet above the floor and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bath room, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

(See Illustration Sec. 470B.)

651. **New Tenements — Habitable Rooms in Basements—Prohibited in Cellars.)** In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such rooms shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building.

652. **Tenement Houses—Requirements for Fireproof and Slow-burning Construction.)** Every new tenement house more than five stories and basement high shall be of fireproof construction. Every new tenement house more than three stories and basement high, but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-

burning construction be required, the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

653. **Frame Tenement — Requirements.)** In every new frame tenement house outside the fire limits, each suite of apartments shall be separated from the next suite in such building by a partition of four-inch tile or of metal studding and metal lath, and the enclosing walls around the stairs, where there are two or more apartments on a floor, shall be of fireproof construction or of solid masonry of the same dimensions as are required by Section 732.

654. **Frame Additions to Frame Tenement Houses Within Fire Limits Not Permitted—removal of Frame Tenement Houses.)** No frame addition shall be permitted to any frame tenement house within the fire limits, either by adding to its height or its superficial area.

If a tenement house, standing on wooden supports, is moved to another lot, it shall not again be placed on wooden supports, but shall be placed on a masonry or concrete foundation.

If a frame tenement house, not more than two stories high, is moved from one location to another upon the same lot, it may be set upon wooden posts and a basement or cellar not to exceed six feet six inches in height from the floor to the ceiling thereof may be maintained thereunder, and no habitable rooms shall be constructed or occupied in said basement or cellar.

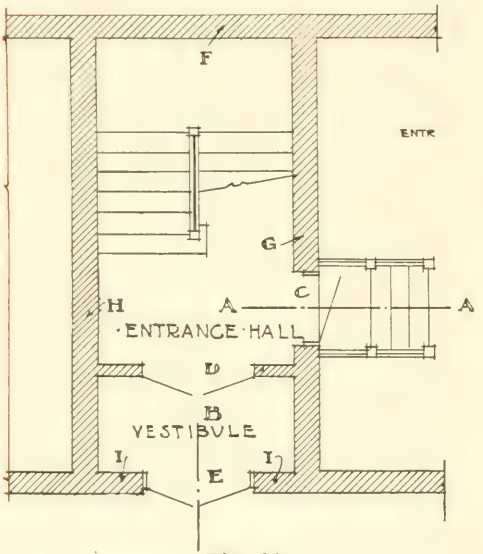

Fig. 14.

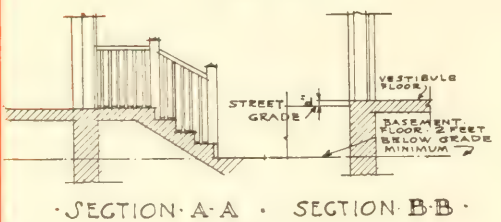

Fig. 15.

SECTION 656 B.

Beginning, where the main entrance vestibule, etc. If walls F H G I, also floor and ceiling of entrance hall A, and floors and ceiling of vestibule B, are of fireproof construction, and door C is a fireproof door with fireproof frames, the vestibule B may be built 2" above level of outside grade without changing the definition of the word "basement"—see section 634.

Doors E and D do not have to be fireproof—see section AA and BB for condition at hand.

655. **Entrance Halls—Solid Masonry—Exceptions—Ceilings.)** Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there be only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the following sections of this ordinance as to the construction of stair halls. If such main entrance hall is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs, respectively, shall be increased respectively at least one foot in width for each additional flight of stairs.

656. **Stair Halls—Construction of—Handrails.)** (a) The stairs and stair halls in all new tenement houses more than three stories and basement or cellar high shall be constructed of incombustible material throughout, except that the treads of stairs may be of wood not less than one and three-eighths inches thick and all handrails may be of hardwood.

(b) In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with walls of solid masonry of the dimensions required by Section 732. All windows in stair halls, except where same open into a street, alley, outer court, or yard, shall have metal frames and sashes, glazed with wired glass. This section shall not apply to tenement houses which are not more than three stories and basement high with only one apartment on each floor. Where the main entrance vestibule and entrance hall or corridor of said building, including the floor and ceiling thereof, are of fireproof construction as defined in this chapter, from the outside face of the building at said entrance to and including the floor of stair hall, and all doors leading therefrom or thereto except the street doors are fire retarding doors, the floor of said entrance and vestibule may be built at a level of two inches (2 in.) above the level of the outside grade of the building at the entrance of same, without changing the definition of the word "Basement" with regard to height of floors, as contained in Section 634.

(See Illustration Sec. 613.)

657. **Apartments Divided by Masonry.)** (a) There shall be a wall of solid masonry of thickness as required by Section 732 extending from the ground to the roof between each set of apartments and around each court and each light shaft, except as hereinafter provided; (1) provided, however, that a wall between apartments and extending from the main stair hall to the outer wall of the building may be offset at the second story floor line to some point nearer the center of the building, or of the group of apartments, to admit of an even distribution of space in the rooms adjacent to such wall, if such wall is supported at the second story floor line on fireproofed steel or iron beams which extend from the brick wall surrounding the main stair hall to the outer wall of the building; and provided, further, that such offset wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams

carried by masonry walls as above specified; (2) and provided, that, in case there is a store or stores in the first story of a building of this class, a masonry dividing wall between apartments may begin at the second story floor line, if such dividing wall is supported on fireproofed steel or iron beams carried by masonry; and provided, further, that such dividing wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry. In buildings of fireproof construction the partitions between apartments, and around stairs may be of burnt clay tile not less than three inches in thickness or reinforced concrete partitions not less than three inches in thickness.

(b) In buildings of ordinary construction two separate thicknesses of metal lath and fire-resisting plaster shall be used as fireproofing as required by this section.

658. **Ceiling Over Stores — Courts and Shafts Beginning Above First Story.)** (a) In every new non-fireproof tenement house in which there is a store or stores in the first story, if the building is three stories or less in height, the portions of the first story ceiling directly under all public halls shall be of slow-burning construction, and if the building is four or more stories in height the entire basement and first story construction and the second story floor construction shall be of fireproof construction.

(b) In every new non-fireproof tenement house the masonry walls enclosing every court or light or vent shaft beginning above the first story shall be supported on fireproofed steel or iron beams carried by masonry or by fireproofed steel or iron columns; and such court or shaft enclosing walls may be reduced to the thickness of eight inches if supported at every intersecting floor line on fireproofed steel or iron beams carried as above specified.

659. **Damp-Proofing—Basement Wall to Be Masonry—Cement Floor.)** In every new tenement house constructed of brick or frame, the foundations and basement walls shall be built of masonry or concrete not less than twelve inches in thickness, except as provided in Section 732 and shall have all outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar of every existing and new tenement house shall have a floor of Portland cement concrete not less than three inches in thickness laid on not less than six inches of sand or cinders.

(See Illustration Sec. 634.)

660. **Bay Windows—Courts—Vent Shafts.)** (a) The walls of every bay window and every court in masonry constructed new tenement houses shall be built of brick or other fireproof construction as required for exterior walls.

(b) The walls of every interior vent shaft in masonry constructed tenement houses shall be built of masonry or of fireproof material not less than four inches in thickness, supported by steel or iron.

661. **Porches.)** (a) Where porches are constructed in courts of now existing or new tenement houses, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No additional rear porch shall be constructed on any existing tenement house in such way that the buildings on the lot with all their porches shall occupy a greater proportion of the lot than is permitted in Section 642 of this chapter. No rear porch on any existing tenement house where the total area of buildings and all porches exceeds the proportion of the lot permitted in Section 642 of this chapter shall be reconstructed until the plan for such re-construction shall have been submitted to and approved by the Commissioner of Buildings. No rear porch built of combustible materials and more than eight feet in width, excepting stairways, shall be constructed on any new tenement house nor added to, nor reconstructed on any existing tenement house.

(b) Front porches of buildings in existence at the time of the passage of this ordinance may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided that the glass area shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half of their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and the area of such open sash shall be at least twice the area of all windows from adjacent rooms opening on to porches so enclosed, unless such room adjoining said porch shall have windows opening on to a street, alley, yard or court of proper legal dimensions as required by this chapter for habitable rooms in addition to the windows opening on to the porch, in which case the amount of movable sash in porch enclosure shall be not less than ten per cent of the floor area of said porch and in no case less than ten square feet of glass area.

(c) Rear porches and side porches of buildings in existence at the time of the passage of this ordinance, where every part of said porch is at least ten feet distant from any other building, porch or structure located upon the same lot with the building of which such porch is a part, may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided, that the glass area of the enclosure shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and in no case shall be less than three times the area of all windows, doors and transoms opening on to said porch, and that in every case the top of the sash in such enclosure shall be at least six inches higher than the top of the windows and doors opening on to such porch. The framing of the porch enclosure may be of wood, and the glass area of each side and of each end of such porch shall be not less than fifty per cent of the entire side or end of such porch enclosure measured from the floor of the porch to the under side of joists immediately above such porch in each story.

(d) In every building erected after the passage of this ordinance, every front porch, rear porch or side porch which is intended to be enclosed must have enclosing walls as required by the ordinances of the city for enclosing walls of a building of the type of which said porch is a part, and every porch so enclosed shall be considered a separate habitable room and shall comply with all the requirements of this chapter for habitable rooms, and such porch enclosure shall not in any manner intercept the light or the ventilation of any adjoining room.

(e) Where buildings do not exceed three stories in height the stairways in rear porches may be partially enclosed as follows; the end of the porch outside the stairway, also the back of the porch around said stairway not to exceed eleven feet in ex-

tent, may be enclosed with wood or frame construction and a window with glass area of nine square feet shall be placed in the back enclosure or in that part of the porch facing the yard or court on each story.

662. **Flues and Chimneys.)** In every building used for the purposes of Class VI, the flues or chimneys shall conform to the following regulations: For one stove opening, the flue area shall be not less than forty-nine square inches. For more than one stove opening and one furnace opening the flue area shall be not less than seventy-seven square inches. All such flues shall be constructed according to the requirements of Section 800 of this chapter.

663. **Bulkhead in Roof—Construction of —When Required.)** There shall be in the roof of every new tenement house, unless the pitch of the roof thereof exceeds one foot rise in four foot run, at least one bulkhead or scuttle, fireproof or covered with fireproof material, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. Where such tenement house is provided with rear stairs, there shall be a bulkhead or scuttle accessible from each of such rear stairs. No scuttle or bulkhead door shall have any lock on it but may be fastened on the inside by movable bolts or hooks.

664. **Stairways—Width and Construction of —Handrails.)** (a) Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story, and which stairs shall be as far apart as practicable. One of said stairways shall be an interior stairway. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs without going through any other apartment. An apartment whose gross floor area does not exceed 1,000 square feet and having not to exceed six habitable rooms in an existing tenement house and which at the time of the passage of this ordinance had not access to two stairways, may have exit to a second stairway through another apartment, providing the door between the two apartments is equipped with a glass panel not less than five feet high and twenty inches wide, with the bottom of same not less than eighteen inches above the floor. Or where the floor level of said apartment is not more than twelve feet above the surface of the yard or ground surrounding the building, a balcony with an area not less than eighteen square feet equipped with a drop ladder to the ground may be attached to the outside wall of said building accessible by a door or window from such apartment. Such glass panel, door or balcony and ladder, as the case may be, shall be considered as a secondary means of exit from said apartment, if in the judgment of the Commissioner of Buildings such glass panel door, balcony and ladder will afford safe means of exit for any such apartment. Where halls or stairs in an existing tenement house have been damaged by fire or otherwise to an extent greater than one-half the value thereof, such halls or stairs so damaged shall be repaired so as to conform to the requirements of this chapter with regard to halls and stairways relating to new tenement houses.

(b) All enclosed stairs in every tenement house shall have at least one handrail, and where the width of such stairs is greater than 3 feet 6 inches, such stairs shall have a handrail on each side thereof. All open stairs shall be provided with suitable and substantial handrails on each side.

(See Illustration Sec. 613).

665. **Stairs in Non-Fireproof Buildings, Eighty or More Rooms.)** Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in this chapter.

666. **Stairs in Fireproof Buildings, One Hundred and Twenty Rooms and Upward.)** Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building may be made at least one-half wider than is provided in this chapter.

667. **Stairs—Entrance to — Treads and Risers.)** Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

(See Illustration Sec. 613).

668. **Fire Escapes.)** Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by this chapter. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access, without passing through any other apartment, to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then such apartment shall have direct access to a stairway fire escape. Every court in which there is a fire escape shall have direct and unobstructed access along the surface of the ground to a street or alley or to yard opening into an alley or street without entering into or passing through or over any building unless by a four foot wide fireproof passage on the court or ground level. Except as herein specifically provided, the number, location, material and construction of fire escapes shall be controlled by the general provisions of this chapter on fire escapes.

669. **Shafts, Courts, Yards, Graded — Drained.)** In every now existing and new tenement house, the bottom of all shafts, courts or yards shall be provided with sanitary drainage and shall be graded or paved.

670. **Access to Rooms—Otherwise than Through Bedroom.)** In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment shall be had without passing through any bedroom.

671. **Water Closets—Window in—Artificial Light.)** (a) In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, except that where there are

apartments consisting of only one or two rooms, in which case there shall be at least one water closet for every two apartments.

(b) Every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a vent shaft of at least one-half the minimum area required in Section 645. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass panels or transoms.

672. **Sinks — Requirements.)** In every new tenement house there shall be in each apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be woodwork inclosing sinks; the space underneath sinks shall be left entirely open.

673. **Pipes Through Floors—Catch Basins—Water Closets.)** (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable, be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the Commissioner of Health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

674. **Buildings Damaged by Fire, Etc.)** If any existing tenement house is hereafter damaged by fire or other cause, including ordinary wear, so that at any time its value be less than one-half its original value exclusive of the value of the foundations, such building shall not be repaired or rebuilt except in conformity with the provisions of this ordinance applicable to new tenement houses.

675. **Provisions of this Article Not to Apply to Existing Buildings, Except Under Certain Circumstances—Then Commissioner to Notify.)** (a) Nothing in this Article contained shall be construed as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this Article and which at the time of their construction were built in compliance with the ordinances then in force, unless they are in conflict with the requirements of Section 649, 668, 669, 672, 677, 678, and 679 or unless such buildings shall not have sufficient or adequate means of egress therefrom, by reason of insufficient or inadequate stairways, improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

(b) Where it shall appear to the Commissioner of Buildings that any such building has insufficient means of egress therefrom as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building, as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

676. **Rooms and Halls — Additional.)** Every room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this ordinance as to size, arrangement, light and ventilation of rooms and halls.

677. **Rooms — Change in Existing.)** No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet and a minimum width of not less than two feet six inches, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room, provided, however, that all of the requirements of Sections 641 and 642 shall be complied with.

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of Section 654 of this Chapter.

(See Illustration Sec. 470 B).

678. **Windows—Courts—Attic.)** No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and, provided, further, that such attic room has not less than seven hundred fifty cubic feet of air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

(See Illustration Sec. 470 B).

679. **Existing Tenements—Living Rooms in Cellars or Basements—When Permitted.)** (a) In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided that no such room shall be used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least 15 per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another or from one location to another on the same lot and a basement or story, or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of Section

872, and the habitable rooms therein shall comply with the provisions of Section 677, and the space on the lot shall comply with the provisions of Section 641 and Section 642.

680. **Insanitary Conditions — Nuisance.)** A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endangers the public health, is hereby declared to constitute a public nuisance.

ARTICLE X.

Class VII.

681. **Class VII Defined.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

682. **Must Comply With General and Special Provisions.)** Every building of Class VII shall comply with the general provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

683. **Buildings of Class VII—Construction of.)** Buildings three stories or less in height, used either wholly or in part for the purpose of Class VII, may be of ordinary construction. Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction. Such buildings over five stories in height shall be of fireproof construction.

684. **Stores Used for Retail Sale of Goods or Manufacturing Purposes—Occupation of Basement—Lockers.)** (a) Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for locker provisions in excess of accommodations for the number of employes on the floor on which they are employed, or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII except as hereinafter provided; provided, however, the stories above the twelfth story may be used for these or other purposes when equipped with an approved automatic sprinkler system approved by the Chief Fire Prevention Engineer; and provided further, that all such buildings hereafter erected to be used for these purposes, or so used, above the twelfth story shall in addition to being equipped with an approved automatic sprinkling system have enclosed stairways.

(b) Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the floor nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade: Provided, however, that in all existing buildings of fireproof construction having a floor not more than thirty-two feet below the inside street grade, and having a partial intermediate floor or gallery between such floor and the level of the inside street grade, with an opening through such intermediate floor not less than forty feet by forty feet in area, and having direct exits on such floor and intermediate floor or gallery connecting on substantially the same levels with the floors of adjacent buildings of fireproof construction, the retail sale of goods shall be permitted on such floors not more than thirty-two feet below the inside street grade if such floors shall be properly and thoroughly ventilated and mechanically supplied with not less than two thousand cubic feet of air per hour for each twenty square feet of floor area, exclusive of walls, stairs and elevators, and if such buildings are equipped throughout and on such floors below the inside street grade with an automatic sprinkler system approved by the Chief Fire Prevention Engineer; and if the number and character of stairways and emergency exits comply with the provisions of this chapter applicable to buildings of Class VII of fireproof construction; and further provided, that in addition to the foregoing requirements there shall be at least one fireproof stairway enclosed in a fireproof tower extending from such sub-basement to the first floor of such building with no openings into said tower except from the sub-basement and first floor.

(c) Except as above provided in paragraph (b) of this section in relation to existing buildings, no sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor, inclosed in fireproof partitions. Such stairs from such locker or dressing rooms shall be, in addition to other stairways required by this chapter for such buildings, and at least one of such stairways shall open directly on a street, alley or court opening on a street or alley, or on a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room, such lockers shall be of incombustible material.

(d) Where stories above the twelfth story are used for the purposes of Class VII as hereinbefore described for locker provisions in excess of accommodations for employes on the floor on which they are employed, then the stairways from the first to the topmost floor shall be built and inclosed as described in Section 880, but the stairways shall be in number and aggregate width as required in the table for stairways set forth in Section 878 of this chapter.

685. **Floor Areas—Maximum.)** (a) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of ordinary construction shall not exceed nine thousand square feet.

(b) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

(c) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of fireproof construction shall not exceed 25,000 square feet, unless the building is completely equipped with an approved automatic sprinkler system, but in no case shall such area exceed 30,000 square feet.

686. **Floor Areas—Exceeding the Maximum Limits Defined in Section 685.)** (a) Where any floor or portion of a floor used for the purposes of Class VII in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls, or dividing walls built in accordance with the provisions of Section 463 of this chapter relating to dividing walls in buildings of Class I.

(b) Where any such floor so used is divided by such fire walls or dividing walls,

each such division of such floor shall be provided with stairs, aisles, exits, and fire escapes as required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate

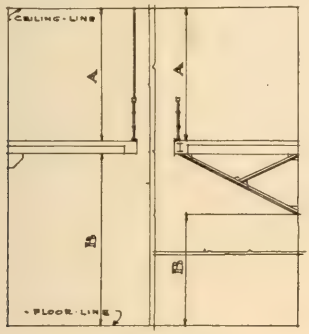

Fig. 16.

SECTION 687 C.

A—height from floor of any gallery, mezzanine or intermediate floor to ceiling over same.

B—space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, etc., is placed.

Explanation:

A—shall not be less than 7′0″.
B—shall not be less than 7′0″.

building, except as provided in Section 712 of this chapter.

687. **Galleries.)** (a) The area of any or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII in any building shall not exceed ten per centum of the area of such story. Galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

(b) Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

(c) The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet of space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

(d) Every gallery, mezzanine or intermediate floor in any building used for the purposes of Class VII shall be built to conform to the construction applicable to such building, but galleries not exceeding five per centum of the area of such story, may be built of incombustible material without fireproof protection.

(e) No gallery, mezzanine or intermediate floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, mezzanine or intermediate floor shall be filed with the Department of Buildings when a permit is applied for.

688. **Courts of Class VII Buildings.)** (a) Every court or light shaft of every building used wholly or in part for the purposes of Class VII shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portions thereon of wired glass.

689. **Stories—Numbering of.)** The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered consecutively, the second, third, and so on.

690. **Stairs — Halls — Passageways and Aisles—Signs and Lights.)** (a) The stair halls, passageways and stair aisles shall be unobstructed and be as wide as the stair and not less than four feet wide in the clear.

(b) The exit door or doors between floors and stair halls shall be not less than ninety per centum of the width of the stairway to which they afford access, and for each elevator opening into such a stair hall, the doors to floors shall be increased six inches in width.

(c) The stairways and stair halls of any building used wholly or in part for the purpose of Class VII shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

(d) At the bottom of each such stairway there shall be an illuminated red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

691. **Exit Signs and Lights.)** (a) All exits in buildings used wholly or in part for the purposes of Class VII shall be clearly indicated by illuminated red signs with the word "Exit" thereon in letters not less than six inches high. At the bottom of each stairway on the street floor level there shall be similar signs indicating the direction of the nearest exit to a street or alley.

(b) Fire escape doors or windows shall be indicated by illuminated red signs with the words "Fire Escape" thereon in letters not less than six inches high.

692. **Doors at Street Level—Revolving Doors.)** The clear width of the exit openings shall be computed in the same manner as that provided in this article for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

693. **Doors in Dividing Walls.)** (a) Door openings may be built in dividing walls of such buildings; provided, however, that such door openings shall be not less than five feet in width and shall be provided with fireproof doors built as described in Section 789 of this chapter, and that each door shall have an efficient closing device which will operate automatically in the event of a fire in close proximity to either side of such door.

(b) Each such opening shall have exit signs and lights as provided for street doors and exits in Section 691 of this chapter.

694. **Loads—Allowance for Live Loads in Construction of Floors of Buildings of Class VII.)** For all buildings of Class VII the floor shall be designed and constructed in such a manner as to be capable of supporting, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors, and shall be figured in accordance with Section 729 of this chapter.

ARTICLE XI.

Class VIII.

695. **Class VIII Defined—Provisions of.)** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

696. **Must Comply With General and Special Provisions.)** All buildings of Class VIII shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to such general provisions shall comply with the following special provisions:

697. **Construction of.)** (a) All buildings hereafter erected and used or intended to be used wholly for the purposes of Class VIII shall be constructed in accordance with the provisions of this chapter relating to Class VIII; and existing school buildings shall comply with the provisions of Class VIII with reference to stairs, exits and fire escapes.

(b) Buildings which have a seating capacity of two hundred or less and which are not over two stories and basement in height, may be built of ordinary construction; provided, that no portion of such building shall be used for assembly hall purposes.

(c) Buildings which have a greater seating capacity than two hundred and not exceeding four hundred, and which are not over three stories and basement in height, shall be built of slow-burning or fireproof construction.

(d) Buildings which have a greater seating capacity than four hundred, or which are more than three stories and basement in height, shall be built entirely of fireproof construction.

(e) Additions to existing buildings shall be built of the several types of construction required by this section; provided, however, that the sum total of the seating capacity of the entire building, including additions, shall be counted in determining the type of construction required for such addition.

(f) All alterations in existing buildings used for the purposes of Class VIII, other than new additions thereto, and intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials originally used in such buildings, unless otherwise distinctly provided herein.

698. **Walls—Window Openings in.)** No wall of any building used for the purposes of Class VIII and containing a window opening shall be nearer than five feet to any lot line of adjoining property, street and alley lines not included.

699. **Portable Frame Buildings.)** Portable frame buildings used wholly for the purposes of Class VIII, not larger than 28 by 36 feet and not over one story high, may be erected, provided exterior walls and roof of same are covered with metal or other incombustible material, and the interior woodwork painted with fire-retarding paint approved by the Commissioner of Buildings; and, provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the original permit.

700. **Assembly Halls—Limitations as to Seating Capacity and Floor Level.)** (a) The limit of height at floor level and the maximum seating capacity of assembly halls or auditoriums or other single rooms in buildings of this Class must not exceed the numbers given in the following table, for the specified type of construction, to-wit:

Floor—Height of Above Grade.	——Type of Construction—— Fireproof Construction.	Slow burning or Mill Construction Having Fireproof Stairs and Corridors.	Ordinary Construction.
	Persons.	Persons.	Persons.
Over 60 ft.....	500	100	...
60 ft. or less..	600	300	...
45 ft. or less..	700	500	...
30 ft. or less..	1000	800	250
20 ft or less..	1500	900	500
10 ft. or less..	2000	1000	800
5 ft. or less..	2500	1200	1000

(b) All assembly halls or other single rooms having a seating capacity larger than that given in the above table must have the highest part of the main floor within not more than one foot of grade level and must have exits leading directly to three streets, public alleys, or to open public grounds.

(c) Seating capacity of all assembly halls in buildings of this Class shall include the total aggregate seating capacity of all balconies, galleries, stages and platforms as well as the main portion of such assembly hall or rooms.

(d) Heights of assembly hall floors shall be measured from sidewalk level at entrance of building or open school grounds to highest part of main floor of such assembly hall or rooms.

701. **Stairways — Width of — Handrails.)** (a) Stairways in buildings used for the purposes of Class VIII shall be equivalent in width to fifteen inches for every hundred of seating capacity in such building as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

(b) No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet in width in the clear may be counted in the total width of stairs required.

(c) Where two or more stairways are used, they shall be placed at opposite ends of the building or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one sliding or stairway fire escape.

(d) All stairways in buildings of Class VIII shall have hand railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, the dimensions of which, in the direction of the run of the stairs, shall not be less than four feet, or which, if at a turn of the stairs, shall be of not less width than the width of the stairs. No winder shall be permitted in any stairs. Stairways

which are over nine feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high at each stair landing. All stairways shall discharge at the bottom directly to a public thoroughfare or open ground.

(See Illustration Sec. 613).

702. **Stairways in Buildings Hereafter Erected—Fireproof.)** In buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

703. **Width of Corridors, Passageways, Hallways and Doorways.)** The width of corridors, passageways, hallways and doorways shall be equivalent in width to eighteen inches for every one hundred of seating capacity of such portions of building as will be required to use same for exit. No corridor, passageway or hallway shall be less than five feet in width, and no doorway less than three feet in width, except where two or more doors, each two feet eight inches or more in width, are grouped together.

704. **Doors to Open Outward—Covering of.)** All doors in such buildings shall open outward. All exit doors from assembly halls to other parts of the building shall be covered with metal or other fireproof material approved by the Commissioner of Buildings.

705. **Aisles—Width of—In Assembly Halls and in Recitation and Study Rooms.)** (a) Aisles in assembly halls in buildings of Class VIII shall be equivalent in width to eighteen inches for every one hundred seating capacity in such assembly hall, but no such aisles shall be less than two feet six inches in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

(b) Aisles in class rooms, recitation rooms and study rooms of such buildings shall be equivalent in width to eighteen inches for every one hundred permanent seats in any such room, but no aisle shall be less than sixteen inches in width and no main or cross aisle be less than two feet six inches in width.

706. **Emergency Exits for Assembly Rooms—Aggregate Width of.)** All assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with at least two emergency exits. The aggregate width of such emergency exits, which shall be provided for each floor, balcony or gallery of such assembly hall, shall be not less than nine inches in width for every one hundred of seating capacity or portion thereof. No emergency exit or stairway shall be less than three feet in width. Emergency exits must be located as far apart and as far from main exits as practicable, subject to the approval of the Commissioner of Buildings.

707. **Lights in Buildings—Window—Skylights.)** (a) Provisions shall be made to properly light every portion of any such building devoted to the uses or accommodations of the public and all outlets therefrom leading to the street, including the open courts and corridors, stairways and exits, during the entire time such building is in use.

(b) All gas or electric lights in the class rooms of main building and in halls, corridors, lobbies, stairs and exits leading from the assembly halls shall be independent of lights in assembly hall. By "independent" shall be construed a separate pipe from meter or separate circuits from switchboard.

(c) The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-fifth of the floor area of such room.

(d) Class rooms, recitation rooms and study rooms that have exterior windows on one side only must have the top of glass in such windows at a height above the floor of such room of not less than one-half of the distance to the opposite parallel wall or partition.

(e) Such rooms having exterior windows on two opposite sides of the room shall have the top of glass in such windows not less than one-fourth the distance between walls in which the windows are placed. The height of windows in corner rooms having windows in adjacent walls shall be computed from nearest wall or partition to opposite window.

(f) Where skylights or skylights and windows of sufficient size to give the proper glass area are used these heights of windows shall not be required.

708. **Scenery—Sliding Curtains—Screens.)** No curtains or scenery shall be used in any assembly hall, except only, that it shall be permissible to use a pair of sliding curtains hung on horizontal metal rods not over twelve feet above the floor of stage and portable screens set on the floor and not over eight feet high. Provided, however, in assembly halls located on the first floor or ground floor of a fireproof building, it shall be permissible to use curtains hung from the ceiling or top of proscenium opening.

709. **Moving Picture Machines.)** Moving picture machines may be installed and used in assembly halls located on the first floor or ground floor of fireproof buildings of Class VIII. When moving picture machines are so used they shall be located in booths constructed of fireproof materials with metal clad doors and a vent duct to the outside air having a cross sectional area of at least 100 square inches.

710. **Basement When Used for Class Rooms.)** (a) In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building.

(b) Class rooms, recitation rooms or study rooms shall not be allowed in basements less than twelve feet in height in the clear nor where the floor is more than two feet below the level of the sidewalk at nearest entrance of building nor in basements which are not properly lighted by windows or skylights as defined elsewhere in this Chapter for such rooms.

711. **Stories—Height of.)** No story above the basement shall be less than twelve feet in height in the clear.

712. **Fire Escapes.)** (a) Every building used for the purposes of Class VIII of **four** or more stories in height, shall be provided and equipped with stairway fire escapes or sliding fire escapes as herein provided:

(b) All such buildings having a seating capacity of less than two hundred on any one floor above the **third** floor shall have at least one such fire escape.

(c) All such buildings having a seating capacity of over two hundred but less than four hundred in any one story above the **third** floor shall have at least two such fire escapes.

(d) All such buildings having a seating capacity of more than four hundred but less than six hundred on any floor above the **third** floor shall have at least three such fire escapes.

(e) At least one additional stairway or sliding fire escape shall be provided for every increase of two hundred seating capacity in any one story above the **third** floor.

(f) Stairway fire escapes shall be built in accordance with the requirements of Sections 881, 882 and 885, and shall be subject to the approval of the Commissioner of Buildings.

(g) Sliding fire escapes shall be securely anchored or fastened to the building and shall have a radius or width of not less than thirty-six inches, and the inner side of the same shall be entirely smooth and made of metal. There shall be an entrance to each sliding fire escape from each floor above the first story. They shall be of a pitch of not less than thirty degrees nor more than forty-five degrees for straight runs. They shall be so constructed that they will discharge people not more than twenty-four inches from the adjacent ground or floor. They shall be of such pattern and design as will best secure the safety of the public, and their construction, location and maintenance shall be subject to the approval of the Commissioner of Buildings. Spiral sliding fire escapes shall have two complete turns for each story height of more than thirteen or less than sixteen feet.

(h) All the provisions of this Chapter relating to outside sliding or stair fire escapes shall apply to buildings of Class VIII, unless such buildings are fireproof, in which case interior fire escapes from ground to roof may be substituted for exterior fire escapes, provided such interior fire escapes shall comply with each and all of the following conditions:

(i) Interior fire escapes in fireproof buildings shall be enclosed in brick or concrete walls on all sides from top to bottom, and shall be enclosed at the top with a fireproof penthouse. The treads and risers of such interior fire escapes shall be the same as those used for stairs elsewhere in the building and the width of such fire escapes shall not be less than forty inches in their narrowest part between hand rails.

(j) The landings of such fire escapes shall, exclusive of and in addition to the space covered or occupied by swinging doors, be at least equal to the stairs in width. All doors leading to such fire escapes shall be incombustible doors and the glass portion thereof shall be glazed with polished wired glass not less than one-quarter of an inch thick, which shall be large enough to enable persons to see other persons on the opposite side of the door. The combined width of said doors on each landing shall exceed the stair width twenty-five per cent, but no single door shall be more than three feet wide. They shall be hinged and equipped with automatic opening and closing devices and shall open outward. Windows lighting such fire escapes shall have metal frames and sash and wired glass.

(k) The number and capacity of such interior fire escapes shall in no case be less than is elsewhere in this Chapter required for outside fire escapes, and the locations of the same shall be as far apart as practicable and so placed as to best secure the safety of the persons using the same in case of fire, accident or panic.

(l) Such interior fire escapes which comply with all the conditions above enumerated may be used daily as ordinary stairs.

713. **The Commissioner of Buildings, the Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, and Superintendent of Police shall close Buildings for Violations.)** The Commissioner of Buildings, the Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, and Superintendent of police, or any of them, shall have the power to close or order closed any building used wholly or in part for the purposes of Class VIII wherein there is any violation of any ordinance which it is their duty to enforce, and to keep the same closed until such provisions are complied with.

ARTICLE XII

Class IX.

714. **Class IX Defined.)** In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

715. **Requirements General.)** Every building of Class IX shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to the general provisions shall comply with the following special provisions:

716. **Construction.)** (a) All buildings of Class IX not more than two stories and basement in height may be of ordinary mill, slow-burning or fireproof construction.

(b) All buildings of Class IX more than three stories and basement high shall be built of fireproof construction.

All buildings of Class IX containing a court room or court rooms above the second story shall be built of fireproof construction.

All buildings of Class IX three stories and basement or less in height which do not contain a court room or court rooms above the second story may be built of ordinary construction **excepting** that part of the building containing the cell room or lockup and the patrol wagon quarters, or either of them, which part shall be built of fireproof construction and shall be separated from all other parts of the same building by a wall of the same character and thickness as is required by this chapter for the outside walls of such building and where necessary by a fireproof floor and ceiling of the same thickness as the brick walls by which said floor and ceiling is supported.

(c) Buildings erected for or converted to the use of police stations for temporary purposes may be of mill or slow-burning construction not more than ninety feet in height from the average inside sidewalk grade of the street in front of the building to the highest part of the roof of the building.

717. **Allowance for Live Loads and Construction of Floors of Class IX.)** The floors of all buildings of Class IX shall be designed and constructed as follows:

In all buildings of Class IX the floors of all court rooms, and of all public corridors, and of all stairways leading to same, shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and all other floors, or parts thereof, shall be designated and constructed so as to be capable of carrying a live load of fifty pounds for every square foot of floor surface, and such floor-bearing capacity shall be computed in accordance with this chapter.

718. **Windows.)** (a) In every building of Class IX every room, including court rooms, public and private offices, shall have at least one window opening directly upon a street, alley, yard or court; the total glass area of such window or windows shall not be less than one-tenth of the floor area of such room. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened. Such window shall have a glass area of at least ten square feet unless it be a window in excess of one-tenth of the floor area as required by this paragraph. Cell blocks shall have at least three outside walls of same to face upon a street, alley, yard or court and where windows are placed in the three sides with a total glass area equal to one-fourth of the floor area of such block and each win-

dow is arranged so that it may be opened for one-half of its area, it shall not be required that each cell open onto a street, alley, yard or court. No sleeping rooms or cell rooms shall be allowed below the first floor level in any building of Class IX.

(b) In every building of Class IX every pantry, bath room, water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such windows shall be not less than one-tenth of the floor area of such room or compartment. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened; and no such windows shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located on the upper story of such building, may be lighted and ventilated by means of a skylight having a glass area of at least one-tenth the floor area of the room it serves and is equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth the floor area of such room.

719. **Courts and Shafts.)** In every building of Class IX courts shall be of the minimum width and area as prescribed in Section 644 of this chapter and vent shafts shall be of the minimum width and area as prescribed in Section 645 of this chapter.

720. **Height of Rooms.)** In every building of Class IX the height of all rooms except basement rooms shall be not less than ten feet from the level of the floor to the ceiling thereof, and the height of court rooms, if any, shall not be less than eleven feet from the level of the floor to the ceiling thereof.

721. **Thickness of Walls.)** The walls of every building of Class IX shall comply in thickness with the requirements of Section 732 of this chapter as therein prescribed for buildings of Class I.

722. **Stairways and Fire Escapes.)** Every building of Class IX shall be equipped with stairways and fire escapes in number and dimensions as follows:

In buildings of ordinary, slow-burning or mill construction which do not contain a court room or court rooms and with a floor area of 5,000 square feet or less, two stairways.

With floor area of 5,000 to 9,000 square feet, three stairways.

In buildings of ordinary, slow-burning or mill construction which contain court rooms and with a floor area of less than 5,000 square feet, two stairways and one stairway fire escape.

With floor area of 5,000 to 9,000 square feet, three stairways and one stairway fire escape.

In buildings of fireproof construction with a floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

All buildings of Class IX over four stories in height must be equipped with stairway fire escapes as follows:

With a floor area of 7,000 square feet or less, one stairway fire escape, three feet in width.

With a floor area of 7,000 to 21,000 square feet, two stairway fire escapes not less than three feet in width.

No stairways in buildings of Class IX shall be less than four feet in width between hand rails.

In buildings less than three stories high and in buildings three stories high which may be built of ordinary construction by the provisions of this article, stairways may be of ordinary construction enclosed in brick walls of thickness as required by paragraph (h), Sec. 732 of this chapter, or stairways may be of fireproof or incombustible material enclosed in partitions of fireproof or incombustible material.

723. **Exits from Court Rooms—Handrails on Stairways.)** (a) There shall be two direct exits located as far apart as practicable from every court room in a building of this class; the width of such exits shall be computed on a basis of twenty inches for each 100 persons of the aggregate capacity of such court room, and for fractional parts of 100 capacity, a proportionate part of twenty inches shall be added to the width of such exits, but no such exists shall be less than three feet wide in the clear. One of such exits shall open onto a public corridor not less than six feet wide from which there is a stairway leading to the ground at least four feet wide in the clear between hand rails. Where there is but one stairway from such public corridor an additional exit from each court room must be afforded by a stairway at least four feet wide in the clear between hand rails or by means of an outside iron stairway not less than three feet wide; the platform of which shall be placed approximately level with the floor of the court room and accessible by a door not less than three feet in width.

724. **Doors to Open Outward.)** In buildings of Class IX all doors which afford ingress or egress from all rooms, except private offices, shall open outward.

ARTICLE XIII.

General Provisions.

725. **Construction or Alteration of Building — Requirements.)** Every building or structure or part thereof, hereafter constructed, erected, altered, enlarged, repaired or changed within the City shall be so constructed, erected, altered, enlarged, repaired or changed, in accordance with the provisions of this Chapter.

726. **Class of Buildings Not to Be changed Without Conforming to Provisions of This Chapter.)** If buildings, the uses of which bring them within any of the classes mentioned in this Chapter, are to be applied to the uses of any other class for which a better system of construction is required by this Chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this Chapter as specified for their intended use. And it shall be unlawful to use any such building for a new or different purpose from that to which its structure and equipment adapts it under this Chapter, unless a permit for such alterations or use shall have been first obtained from the Commissioner of Buildings and the requirements of this chapter for such new or different use shall have been complied with.

727. **Alterations of Existing Buildings.)** (a) In construing the several sections of this Chapter, said sections shall not be construed as requiring alterations in the construction or equipment of buildings or structures in existence at the time of the passage of this Chapter, except where specifically provided, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto, by reason of insufficient or inadequate stairways or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress and except also as required in sections which are herein made retroactive.

(b) Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has in-

Floor	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
17	85 per cent.																
16	80	85															
15	75	80	85														
14	70	75	80	85													
13	65	70	75	80	85												
12	60	65	70	75	80	85											
11	55	60	65	70	75	80	85										
10	50	55	60	65	70	75	80	85									
9	50	50	55	60	65	70	75	80	85								
8	50	50	50	55	60	65	70	75	80	85							
7	50	50	50	50	55	60	65	70	75	80	85						
6	50	50	50	50	50	55	60	65	70	75	80	85					
5	50	50	50	50	50	50	55	60	65	70	75	80	85				
4	50	50	50	50	50	50	50	55	60	65	70	75	80	85			
3	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85		
2	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85	
1	50	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85

adequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, the Commissioner of Buildings shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to make such building comply with the requirements of this Chapter.

(c) If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make a change in its use or occupation which will transfer it from one class as recognized by this Chapter to another class, then, before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, written notice shall be given to the Commissioner of Buildings of the intention to change the character of the use, and the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into compliance with the provisions of this Chapter.

	Base-ment.	Stories 1	2	3	4	5	6	7	8	9	10	11	12
One-story	12												
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

728. **Removal of Brick, Stone, Frame or Concrete Buildings.)** It shall be unlawful for any person, firm or corporation to move any brick, stone, frame or concrete building from one location to another, unless the same shall be altered or re-constructed so as to conform to the ordinances governing the construction of such building at the time of moving the same and in its new location; provided, however, that whenever a tenement house is moved, the same shall be made to comply with the requirements of Section 677 and Section 679.

729. **Live and Dead Loads—Wind Resistance.)** (a) The "dead load" shall include all permanent portions of the building, also partitions and permanent fixtures and mechanisms supported by the building. The "live load" shall include all movable loads or weights placed on floors or other parts of buildings.

(b) All buildings shall be designed to resist a horizontal wind pressure of 20 lbs. per square foot for every square foot of exposed surface. In no case shall the overturning moment due to wind pressure exceed seventy-five per cent of the moment of stability of the building due to the dead load only.

(c) The "live" loads to be provided per square foot of floor areas, except stairs, for the classes of buildings except portions of Classes VIII and IX as herein otherwise provided shall be not less than the following:

	Pounds.
Class I	100
Class II	50
Class III	40
Class IV	100
Class V	100
Class VI	40
Class VII	100
Class VIII	75
Class IX	100

(d) Provided, however, that in Class VIII the portions of the building exclusive of the floors in assembly halls, the corridors and the stairs, shall not be required to be constructed to support a live load in excess of 40 pounds per square foot.

(e) The roofs of all buildings shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering, of at least twenty-five pounds for each square foot of horizontal surface.

(f) The live loads to be provided for on stairways for buildings of all classes shall not be less than 100 pounds per square foot of treads and landings.

730. **Structural Details—Strength Tests—How Made.)** (a) All structural details and workmanship shall be in accordance with accepted engineering practice, and subject to the approval of the Commissioner of Buildings.

(b) Floors, joists and beams shall be designed for the full dead and live loads. Floor girders shall be designed for the full dead and not less than eighty-five per cent of the live load.

(c) In buildings of Classes III and VI, except frame buildings, where the distance between enclosing walls or intermediate walls is more than twenty-five feet in the clear, intermediate supports for the joists shall be either brick, or concrete, or iron, or steel columns, beams, trusses, or girders.

Amended February 20, 1911.

(d) If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given, in Section 732, as 16 inches or more, be made four inches less in thickness than the dimensions stated.

(e) Tests shall be made by the owner, upon the demand of the Commissioner of Buildings, on all forms of floor construction involving spans over eight feet. Such tests shall be made to meet the approval of the Commissioner of Buildings, and must show that the construction will sustain a load equal to twice the sum of the live and dead loads, for which it was designed, without any indication of failure. The construction may be considered as part of the test load. Each test load shall remain in place at least twenty-four hours. On arch construction, this test load shall be placed on one-half of the arch, covering the area from the support to the crown of the arch.

731. **Walls, Piers and Columns—Dead and Live Loads.)** (a) The full live load on roofs of all buildings shall be taken on walls, piers, and columns.

(b) The walls, piers and columns of all buildings shall be designed to carry the full dead loads and not less than the proportion of the live loads given on next page.

(c) The proportion of the live load on walls, piers, and columns on buildings more than seventeen stories in height shall be taken in same ratio given at top of next page.

(d) The entire dead load and the percentage of live load on basement columns, piers and walls shall be taken in determining the stress in foundations.

(e) In addition to the entire dead loads, not less than the following proportion of the percentage of live load on the basement columns, piers and walls shall be taken in determining the number of piles for pile foundations and the area of concrete caissons.

Classes I and VII..... 75 per cent.
Classes II, III and VI..... 50 per cent.
Classes IV, V and VIII.... 25 per cent.

In all foundations eccentric loading must be provided for.

732. **Requirements for Enclosing Walls—Table of Thickness — Exceptions — Definition of the Length of Wall—Buttresses, Piers or Pilasters — Inserting Columns in Walls — Anchorage of Walls and Floors—Definition and Limits for Height of Stories — Curtain Walls—Interior Walls to Support Fireproof Floor Construction.)** (a) The walls of all buildings, excepting the enclosing walls of frame buildings, shall be of brick, stone or concrete. The walls shall be solid and of solid material and except as otherwise herein provided shall be of the thickness in inches indicated in the following table:

(b) In Class VIII buildings the thickness of surrounding walls and of all dividing walls carrying loads of floors and roof shall be as indicated in the following table:

	Basement.	Stories				
		1	2	3	4	5
	in.	in.	in.	in.	in.	in.
One story	16	12				
Two stories	16	16	12			
Three stories	16	16	16	12		
Four stories	20	20	16	16	12	
Five stories	24	20	20	16	16	16

(c) In Class VIII buildings, walls around stairs, elevators and air shafts and joist supports shall comply with the requirements of Section 855 of this Chapter.

(d) The basement walls of two-story buildings and the first story walls of three-story buildings in Classes III and VI may be twelve inches in thickness. The first story walls of one-story buildings and the second story walls of two-story buildings in Classes III and VI may be eight inches in thickness, provided that where a pressed brick face is used no wall shall be less than twelve inches in thickness, and an eight-inch brick or solid concrete partition wall may be built in a building of any class, but in no case shall any eight-inch brick wall be more than fourteen feet in height.

(e) The basement walls of two-story buildings in Classes II, III and VI may be 12 inches in thickness.

(f) In buildings of skeleton fireproof construction, the thickness of walls shall be governed by Section 837 of this Chapter.

(g) Walls less than fifty feet in length and walls less than fifty feet between cross walls, may be built four inches less in thickness than the thickness given in the aforesaid table, but no such wall in such buildings shall be less than twelve inches in thickness, provided, however, that such walls in buildings of Classes III and VI may be sixty-five feet in length; and further provided, that eight-inch walls may be used in one-story brick buildings and in the second story of two-story brick buildings of said last mentioned classes where said eight-inch

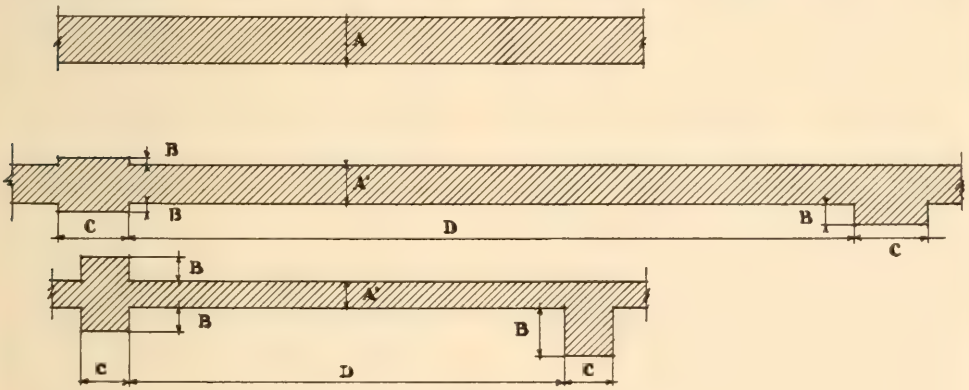

Fig. 17.

THICKNESS OF WALLS. Section 732j.

A = thickness of wall.
A′ = thickness of wall after reduction.
B = projection of buttresses, piers or pilasters.
C = width of buttresses, piers or pilasters.

Explanation:
A may be reduced by ½ B as at A′.
C = 1-10 D.

walls are not more than fourteen feet in height and are supported by a foundation or wall not less than twelve inches in thickness.

(h) A brick wall not more than twenty-five feet long and forming one side of a brick shaft for stair, elevator or other purposes, need not exceed sixteen inches in thickness, nor its upper fifty feet twelve inches in thickness, provided that in no case shall the load on such brick wall exceed the safe load for brickwork prescribed by this ordinance.

(i) The length of a wall shall be the distance in which the wall extends in a straight line and shall be measured between angles of the masonry or between exterior and cross walls.

(See illustration on following page.)

(j) Where masonry buttresses or piers or pilasters are employed on either or both sides of a wall, then said walls may be reduced in thickness by one-half of the projection or projections of the buttresses or piers or pilasters, but no wall shall be reduced to less than twelve inches in thickness. The reduction in thickness may be made throughout the height of the wall, except that no twelve-inch wall shall be higher than thirty feet and no sixteen-inch wall shall be higher than fifty feet. The stress in the brickwork in any part of such walls shall not exceed the stress per square inch allowed by this chapter on the kind of masonry employed. Buttresses or piers or pilasters shall be at least one-tenth as wide, measured on face of same, as the spacing between the buttresses or pilasters. Twelve-inch walls between buttresses or piers or pilasters shall not be used where the distance between buttresses or piers or pilasters is greater than eighteen feet. Sixteen-inch walls shall not be used between buttresses or piers or pilasters where the distance between buttresses or piers or pilasters is greater than twenty-four feet. Twenty-inch walls shall not be used between buttresses or piers or pilasters where the distance between the buttresses or piers or pilasters is greater than thirty feet.

(k) Where buttresses are used, they shall be so placed that the principal girders and trusses shall bear on them.

(l) If the loads carried by trusses and girders are supported by iron, steel, or reinforced concrete columns, then such buttresses as are herein described shall not be required except for the fireproofing of steel and iron columns. The walls between such columns shall be built as required by this Chapter, and said walls shall be anchored to such columns by metal anchors in every seven feet to the height of such column.

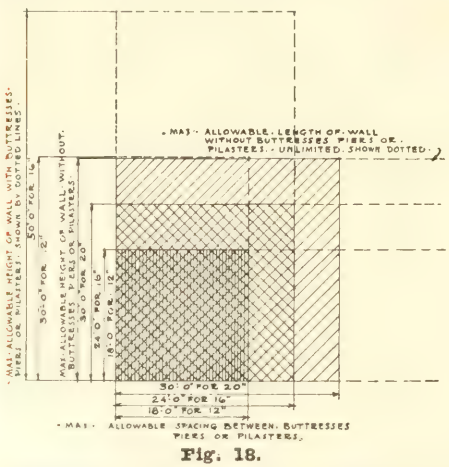

Fig. 18.

Explanatory diagram of maximum allowable height spacing and length of walls with or without buttresses, piers or pilasters.

(m) A structural floor system shall extend from one wall to an opposite wall, and the walls shall be anchored to floor joists or girders or both with iron anchors placed opposite one another, secured to the same joists or girders in pairs, every seven feet or less of length of said walls. Where said joists or girders are of such length that it is not practicable to make them of one piece, then the several pieces shall be joined at each splice or joint by the tie plates or tie bars or other metal connections of the same strength as the anchors. Such anchors shall have not less than four-tenths of a square inch of metal in its smallest cross-sectional area. The spikes, bolts or screws, securing said anchors and tie plates, shall be of such number and size as to transmit the tensile strain which the anchor is capable of resisting into the joists or girders to which said anchors are connected. All pin anchors shall extend at least eight inches into the supporting masonry.

(n) The story height of buildings shall be the distance between structural floor systems or between such structural floor systems and structural roof systems and shall be as follows:

Where 12-inch walls are used, the story height shall not exceed 18 feet.

Where 16-inch walls are used, the story height shall not exceed 24 feet.

Where 20-inch walls are used, the story height shall not exceed 30 feet.

(o) Where the story height is greater than thirty feet, the walls shall not be of less thickness than the following: The upper fifteen feet shall be not less than sixteen inches in thickness, and the walls shall be increased four inches in thickness at each interval of fifteen feet or fractional part thereof of height.

(p) Curtain walls in skeleton construction buildings may be built of hollow clay tile subject to the requirements and limitations of paragraph (c), Section 779 of this chapter, or may be constructed of reinforced concrete subject to the provisions and limitations of Section 766 of this chapter.

(q) The walls of buildings to be used for the purposes of Classes III and VI and not more than two stories in height may be of hollow clay tile or moulded hollow concrete blocks not thinner than the thickness herein required for brick walls, subject to the approval of the Commissioner of Buildings.

(r) Interior brick walls used to support fireproof floor construction, where brick walls are not required by this chapter, may be built thinner than the thickness required by the provisions of paragraph (a) of this section, in case the proportion between the thickness of such walls and the free height between floors does not exceed fifteen, and provided the unit stresses do not exceed the stresses allowed by this chapter, and provided further, that no such wall shall be constructed of a thickness less than twelve inches.

733. **Ledges — Joist Supports.)** (a) In buildings two stories or more in height wherever party walls or partition walls twelve inches or less in thickness are used for the support of wood joists in buildings of Classes I, II, IV, V, VII and VIII the joists shall be supported on ledges of brick formed by corbeling not less than four courses of brick and the upper course shall project four inches beyond the face of the wall, and the joists shall be protected from the bottom to the top of same for the distance of the projection of the corbel by solid brick work laid in mortar.

(b) Wherever iron or steel joist and girder boxes having five complete sides of iron,

nowhere less than ¼-inch in thickness, are used, corbels and ledges as herein specified may be omitted.

(c) In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than two inches.

734. **Walls of Altered Buildings—Increasing Thickness of.)** If the walls of a build-

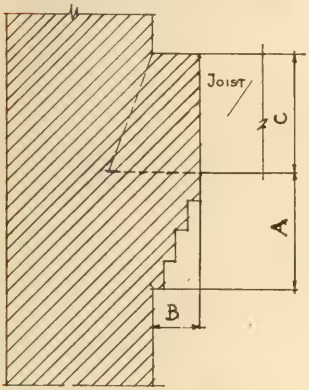

Fig. 19.

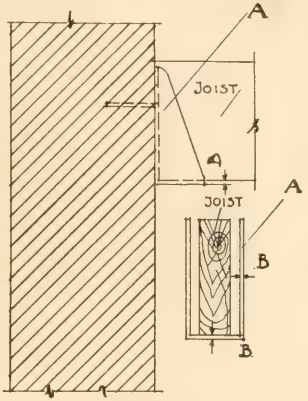

Fig. 20.

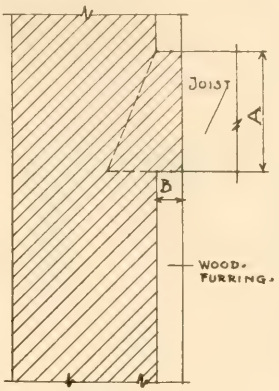

Fig. 21.

LEDGES—JOIST SUPPORTS.

Section 733a, b, c.

Fig. 19 (A) Corbelling to be not less than four courses of brick.
(B) Upper course shall project four inches.
(C) The joists shall be protected from top to bottom by brick.

Fig. 20 (A) Metal joist hanger allowable.
(B) ¼ inch metal required.

Fig. 21 (A) Brick shall project between joists.
(B) Projection of brick to be two inches.

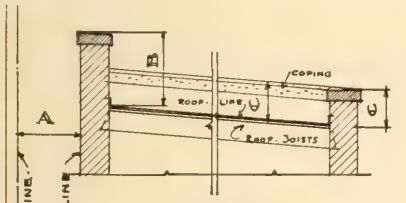

Fig. 22

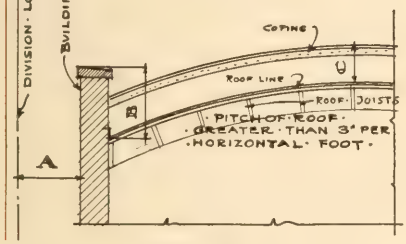

Fig. 23.

Fig. No 22.
A—distance from division lot line to building line.
B—height of parapet wall above roof on division lot line side.
C—parapet wall on other sides when required.
Explanation:
If A is less than 3′0″, B shall be 3′0″.
C shall be not less than 18″.

SECTION 737 D.

Fig. No. 23.
A—distance from division lot line to building line.
B—height of parapet wall above roof, with a greater pitch than 3″ per horizontal foot, on division lot line side.
C—parapet wall on other sides when required.
If A is less than 3′0″, B shall be 3′0″.
C shall not be less than 18″.
For exceptions where fireproof construction is used see ordinance Sec. 737 d, second paragraph.

ing are not of sufficient thickness to comply with the requirements of this Chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall, but bonding with brick or masonry will not be considered as complying with this Chapter; and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

735. **Walls—Party.)** The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

736. **Walls—Erection of—Walls and Skeleton Framework Securely Braced.)** In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall

of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

737. **Parapet Walls—When Required on Walls and Porches—Thickness and Height of.)** (a) On all flat roof buildings parapet walls shall be erected, except as hereinafter provided, on all exterior walls and on all partition walls required by this ordinance by reason of the area of such buildings; provided, that such parapet walls may be dispensed with on any wall of a fireproof building, and on street and alley walls and on yard and court walls of buildings of other types where the entire framing and materials of the roof are strictly fireproof or where all portions of the roof nearer than fifteen feet to the lot line of such street or alley or bounding such yard or court are protected against fire by a continuous covering of porous or hollow tiles, not less than two inches thick and surfaced with mortar, on top of the roof boards.

(b) Such parapet walls may be eight inches thick wherever this ordinance permits the use of eight-inch walls; elsewhere they shall be not less than twelve inches in thickness.

(c) Such parapet walls shall extend at any point not less than three feet vertically above the roof on all such required partition walls and on all other walls within less than three feet of any division lot line and approximately parallel therewith; elsewhere they shall extend not less than eighteen inches above the roof.

(d) On all buildings whose roofs have a greater pitch than three inches per horizontal foot, parapet walls, of thickness and height as above specified, shall be erected on required partition walls, on exterior walls approximately parallel with and less than three feet distant from a division lot line, and on walls abutting on another building. Provided, that such parapet walls may be dispensed with where the entire framing and materials of the roof are fireproof or where the cornice and roof coverings are of incombustible material and the top of the roof boards is protected against fire for at least five feet up from such wall by a coating of plaster on porous or hollow tiles at least two inches thick; and further provided that such parapet walls and such protection against fire may be dispensed with on buildings of Classes III and VI, three stories or less in height when such buildings have cornices of incombustible material and roof coverings of slate or terra cotta roofing tile.

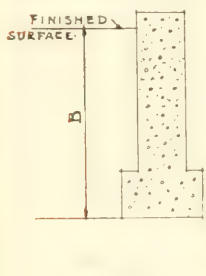

Fig. 24.

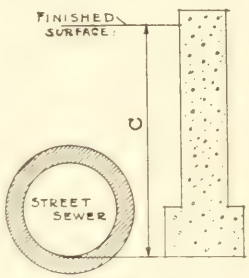

Fig. 25.

FOOTINGS.

Sections 740a, b.

Fig. 24 (B) Shall in all cases extend 4' 0" below finished grade at building, unless footings rest on bed rock—Sec. 740a.

Fig. 25 (C) Buildings 100 ft. or more in height; footings shall extend at least to a depth drained by sewer in adjacent streets and alleys.

Exception if sewer is greater than 10 ft. below sidewalk grade. Such foundation need not extend to a greater depth than 10 ft. if soil conditions are as per ordinance—Sec.740b.

738. **Allowable Stresses and Special Requirements for Foundations—Bearing on Various Soils.)** (a) If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance other than gravel, it shall not be loaded to exceed 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

(b) If the soil is a layer of firm sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it may be loaded not to exceed 5,000 pounds per square foot.

(c) If the soil is a mixture of clay and sand, it shall not be loaded to exceed 3,000 pounds per square foot.

739. **Foundations in Wet Soil—Trenches to Be Drained.)** In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless trenches in which the work is being executed are kept free from water by bailing, pumping, or otherwise, until after the completion of work upon the foundations and until all cement has properly set. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations.

740. **Foundations—Where not Permitted—Depth Below Surface—Independent of Underground Construction Owned or Controlled by the City.)** (a) Foundations must rest on hard sound soil, and shall not be laid or filled or made ground or on loam, or on any soil containing admixture of organic matter. Foundations shall in all cases extend at least four feet below the finished surface of the ground upon which they are built, unless footings rest on bed rock.

(b) Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings 100 feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the adjacent streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

(c) Every building forty feet or more in height, hereafter erected, which is located adjacent to any street or alley containing any then existing water main, water tunnel, sewer, conduit, tunnel, subway or other underground construction, owned or controlled by the City, shall be so constructed that the foundation or superstructure thereof shall not be supported in whole or in part by any such underground construction.

741. **Foundation Construction.)** Foundations shall be constructed of stone, gravel

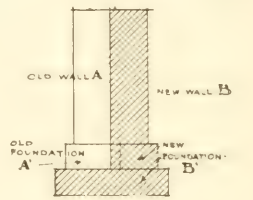

Fig. 26.

SECTION 742.

A—old or present wall.
B—new wall.
A—foundation under old wall.
B—required new foundation.

or slag concrete, dimension stone or rubble stone, sewer or paving bricks, iron or steel imbedded in concrete or piles, or a combination of any of the same. All masonry foundations shall be laid in cement mortar.

742. **Foundation of New and Old Walls.)** In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such a manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits specified in this Chapter.

All foundations shall be protected against the effects of frost, and cement mortar which has been affected by frost, shall not be used in building operations.

743. **Foundations—Pile Borings Required—Safe Load Required—Fiber Stress.)** (a) Where pile foundations are used, the Commissioner of Buildings may require auger borings of the soil to be made to determine the position of the underlying stratum of hard clay or rock. The heads of the piles shall be protected against splitting while they are being driven. The piles shall be sawed off to a uniform level at least one foot below Chicago datum after being driven, and the heads shall be imbedded in concrete or covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the stresses in the materials shall not exceed that prescribed in this Chapter. The top of timber grillage shall be at least one foot below Chicago datum.

(b) The center of gravity of a pile foundation shall coincide with the center of gravity line of the load or loads which it carries.

(c) No pile of less than six inches diameter at small end shall be used.

(d) The safe load on a pile shall be determined by and shall not exceed the following formula:

$$P=\frac{2wh}{S+\frac{1}{10}}$$ for steam hammer;

$$P=\frac{2wh}{S+1}$$ for drop hammer;

In which formula

S=set in inches.
h=fall in feet.
w=weight of hammer.
P=safe load in pounds.

(e) The maximum load on a timber pile shall not exceed 50,000 pounds.

(f) A wood follower shall not be used in determining the safe load.

(g) Plans for pile foundations shall be submitted to the Commissioner of Buildings for approval and shall specify the least diameter of small end of piles, and no piles with smaller diameter of points than that specified for the job shall be used.

(h) There shall not be less than two rows of piles under all external party walls or other walls less than seventy feet high, and not less than three rows under all walls over seventy feet high, excepting under walls not exceeding fifty feet in height a single staggered row of piles may be used if other conditions of stability are complied with.

744. **Concrete Piles Allowable—Compression—Tests—How Made.** (a) Where concrete piles are used test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression of concrete piles shall not exceed 400 pounds per square inch at a section six feet from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within twenty to twenty-four hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until a period of twenty-four hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for twenty-four hours and the total settlement has not exceeded one one-hundredths of an inch multiplied by the test load in tons.

745. **Steel Rails or Beams in Concrete.)** If steel or iron rails or beams are used as parts of foundations, they shall be entirely imbedded in concrete extending not less than four inches beyond the metal.

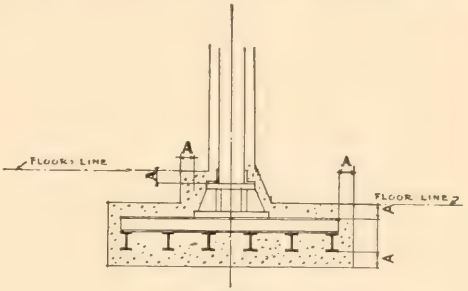

Fig. 27.

Section 745.

(A) Steel and iron rails and beams to be imbedded in concrete, extending not less than 4 inches beyond metal.

(See Special Ruling V, Page 303.)

746. **Allowable Stresses and Special Requirements for Masonry.)** (a) Allowable stresses in pounds per square inch on plain concrete and stone masonry shall not exceed the following:

	Lbs.
Coursed rubble Portland cement mortar	200
Ordinary rubble Portland cement mortar	100
Coursed rubble lime mortar	120
Ordinary rubble lime mortar	60
First-class granite masonry, Portland cement mortar	600
First-class lime and sandstone masonry, Portland cement mortar	400
Portland cement concrete 1-2-4 mixture, machine mixed	400
Portland cement concrete 1-2-4 mixture, hand mixed	350
Portland cement concrete 1-2½-5 mixture, machine mixed	350
Portland cement concrete 1-2½-5 mixture, hand mixed	300
Portland cement concrete 1-3-6 mixture, machine mixed	300
Portland cement concrete 1-3-6 mixture, hand mixed	250
Natural cement concrete 1-2-5 mixture	150

(b) Allowable compression in pounds per

square inch on brick masonry shall not exceed the following:

	Lbs.
No. 1 paving brick, 1 part Portland cement, 3 parts torpedo sand	350
No. 2 pressed brick and sewer brick, mortar same as referred to above	250
No. 3 hard common select brick, Portland cement mortar, same as referred to above	200
No. 4 hard common select brick, 1 part Portland, 1 lime, 3 sand as referred to above	175
No. 5 common brick, all grades, Portland cement mortar	175
No. 6 common brick, all grades, good lime and cement mortar	125
No. 7 common brick, all grades, natural cement mortar	150
No. 8 common brick, all grades, good lime mortar	100

(c) Brick under Nos. 1 and 2 shall not crush at less than 5,000 pounds pressure per square inch of gross area.

(d) Brick under Nos. 3 and 4 shall not crush at less than 2,300 pounds pressure per square inch of gross area.

(e) Brick under Nos. 5, 6, 7 and 8 shall not crush at less than 1,800 pounds pressure per square inch of gross area. Sand lime brick of this crushing strength may be used where common brick is permitted.

(f) Isolated piers of concrete, brick, or masonry shall not be higher than six times their smallest dimensions unless the above unit of stresses are reduced according to the following formula:

$$P \text{ equals } C\left(1.25 \text{ minus} \frac{H}{20D}\right)$$

In which formula

P is the reduced allowed unit stress.
C is the unit stress in the above table.
H is the height of the pier in feet.
D is the least dimension of the pier in feet.

(g) No pier shall exceed in height twelve times the least dimension. Weight of pier shall be added to other loads in computing load coming on the pier.

747. **Definition of Terms Used for the Construction of Walls.)** (a) Wherever the terms masonry, masonry walls or masonry construction, incombustible wall, fireproof wall or wall of fireproof or incombustible material are used with reference to or in connection with the construction of walls in this chapter, such terms are hereby defined to mean solid walls of brick, stone or concrete, built of solid material, except such walls as are allowed under the provisions of Section 779 of this chapter. Where brick is used in the construction of any wall, the length and thickness of such brick may vary, but each brick must be at least three and seven-eighths inches in width.

(b) **Ordinary rubble** is hereby defined as masonry composed of unsquared stones laid without attempting any regularity of courses or bond.

Coursed rubble is hereby defined as masonry having approximately level joints; stones to be roughly shaped so as to fit approximately; joints in wall or pier to be leveled off every three (3) feet in height and to be well bonded.

First class masonry is hereby defined as masonry built of stones in regular courses, the bearing surfaces of which as well as ends, to be roughly tooled off and shall be laid with alternate headers and stretchers so as to secure perfect bond.

748. **Ashlar Facing.)** (a) Ashlar facing of masonry walls shall only be considered as part of wall for the purpose of carrying weight, when it has a minimum bond as follows:

(b) Every second course to be a bond course, this bond course to extend into the backing a distance equal to the least thickness of ashlar. In addition to such bond, each stone in all courses shall be tied to backing by two galvanized iron anchors. No ashlar shall be less than four inches thick, nor shall the height of any stones exceed five times its thickness.

749. **Soft Bricks—Where Not Permitted.)** Soft bricks shall not be used in any part of a building where exposed to the weather, nor in external or internal piers of bearing walls.

750. **Brickwork—Bonding of.)** The bond of all brickwork shall be formed by laying one course of headers for every five courses of stretchers; provided that in the case of pressed brick facing, two headers and a stretcher may be laid alternately in every course or an equivalent number of full headers may be used in any other arrangement approved by the Commissioner of Buildings; and provided further, that pressed brick facing, when not counted as part of the bearing wall, may be laid with fewer or no header courses if anchored to the backing by metal ties of design, material, weight and quantity approved by the Commissioner of Buildings.

751. **Bricks—How Laid.)** All brick laid up in cement, or lime and cement mortar, shall be thoroughly drenched immediately before being laid unless laid in freezing weather. Both horizontal and vertical joints shall be filled with mortar in all kinds of brick masonry.

752. **Allowable Stresses and Special Requirements for Timber.)** The maximum allowable stresses in pounds per square inch on actual sections for timber shall be as follows

	Extreme Fibre Stress and Tension with Grain.	Compression with Grain.	Compression Across Grain in Buildings Hereafter Erected.	*Compression Across Grain in Existing Buildings.*	Shear with Grain.
Douglas Fir and Long Leaf Yellow Pine	1,300	1,100	250	*400*	130
Oak	1,200	900	500	*600*	200
Short Leaf Yellow Pine	1,000	800	250	*300*	120
Norway Pine	800	700	200	*300*	80
White Pine	800	700	200	*300*	80
Hemlock	600	500	150	*300*	60

The unit stress on timber posts shall comply with the following formula:

$$C = 1 - \left(\frac{L}{80D}\right)$$

In the above formula:
C equals compressive strength of timber with the grain as given in the table.
L equals length in inches.
D equals least diameter inches.

The maximum length of a timber post shall not exceed thirty diameters.

Timber columns shall not be used in buildings of greater height than twice the width of the building nor in buildings over one hundred feet in height.

753. **Quality of Timber.)** Timber used for building purposes shall be sound, well manufactured, close grained, free from wind shakes, or from dead, loose, decayed, encased or pitch knots, or knots and other defects that will materially impair its strength and durability.

754. **Maximum Allowable Stresses and Special Requirements for Metals.)** (a) The maximum allowable stresses in pounds per square inch in steel and iron shall not exceed the following:

	Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
Tension on net section	16,000	16,000	12,000	.....
Maximum compression on gross section	14,000	14,000	10,000	10,000
Bending on extreme fibre	16,000	16,000	12,000	.....
Bending on extreme fibre tension	.....	.....	.....	3,000
Bending on extreme fibre compression	.....	.....	.....	10,000
Bending on extra fibres of pins	25,000	.....	.....	.....
Shear: shop driven rivets and pins	12,000	.....	.....	.....
Shear: field driven rivets	10,000	.....	.....	.....
Shear on rolled steel shapes	12,000	.....	.....	.....
Shear plate girder webs; gross section	10,000	.....	.....	.....
Shear on brackets	.....	.....	.....	2,000
Bearing, shop driven rivets and pins	25,000	.....	.....	.....
Bearing, field rivets	20,000	.....	.....	.....

(b) The allowable compressive stresses per square inch shall be determined by the following formulæ:

$$\text{Steel} \quad 16{,}000 - 70\frac{L}{R}$$

$$\text{Wrought iron} \quad 12{,}000 - 60\frac{L}{R}$$

$$\text{Cast iron} \quad 10{,}000 - 60\frac{L}{R}$$

In the above formulæ:
L equals length in inches.
R equals least radius of gyration in inches.

(c) In no case shall the allowable compressive stress exceed that given in paragraph (a) of this section.

(d) For steel columns filled with, and encased in concrete extending at least three inches beyond the outer edge of the steel, where the steel is calculated to carry the entire live and dead load, the allowable stress per square inch shall be determined by the following formula:

$$18{,}000 - 70\frac{L}{R},$$

but shall not exceed 16,000 pounds.

(e) For steel columns filled with, but not encased in, concrete the steel shall be calculated to carry the entire live and dead load. In this case the above formula may be used, but the allowable stress shall not exceed 14,000 pounds.

(f) Stresses due to eccentric loading shall be provided for in all compressive members.

(g) The length of rolled steel compressive members shall not exceed one hundred twenty times the least radius of gyration, but the limiting length of struts for wind bracing only may be one hundred fifty times the least radius of gyration. The limiting length for cast iron columns shall be seventy times the least radius of gyration.

(h) Cast iron columns shall not be used in buildings of greater height than twice the least width, or in buildings over 100 feet high.

(See Special Ruling VIII, Page 303.)

755. **Live and Dead Loads—Stress.)** (a) Wherever the live and dead load stresses are of opposite character, only 70 per cent of the dead load stress shall be considered as effective in counteracting the live load stress.

(b) For stresses produced by wind forces combined with those from live and dead load, the unit stress may be increased fifty per cent. over those given above; but the section shall not be less than required if wind forces be neglected.

(See Special Ruling XIII, Page 305.)

756. **Riveting—Tension.)** (a) In proportioning tension members the diameter of the rivet holes shall be taken one-eighth of an inch larger than the nominal diameter of the rivet.

(b) In proportioning rivets the nominal diameter of the rivet shall be used.

(c) Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member and the net section back of the pin-hole, parallel with the axis of the member, shall not be less than the net section of the body of the member.

757. **Plate Girders — Flanges — Compression.)** (a) Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated at their centers of gravity and a unit stress used such that the extreme fibre stress does not exceed 16,000 pounds per square inch, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section.

(b) The gross section of the compression flanges of plate girders shall not be less than the gross section of the tension flanges; nor shall the stress per square inch in the compression flange of any beam or girder of a longer length than 25 times the width exceed.

$$20{,}000 - 160\frac{L}{B}$$

In which formula
L equals unsupported distance and
B equals width of flange.

(c) The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the effective depth of the girder at that point combined with any load that is applied directly on the flanges.

(d) Webs of plate girders shall be provided with stiffeners over all bearing points, under all points of concentrated loading and elsewhere when required by good engineering practice.

Reinforced Concrete.

(See Special Ruling II and III, Page 295.)

758 **Reinforced Concrete — Definition — Plans.)** The term "Reinforced Concrete" is hereby defined as any combination of metal imbedded in concrete to form a structure so that the two materials assist each other to sustain all the stresses imposed. Before a permit to erect any reinforced concrete structure is issued, complete plans and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, including detail of working joints, the size and position of all reinforced rods, stirrups or other forms of metal, and giving the composition and proportion of the concrete; provided, however, that permission to erect any reinforced concrete structure does not in any manner approve the construction until after tests have been made of the actual construction to the satisfaction of the Commissioner of Buildings.

(See Special Ruling III, Page 295.)

759. **Ratio of Moduli of Elasticity—Adhesion—Bond.)** (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

Mixture.	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag	2,900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2,400	12
1 cement, 2 sand, 4 broken stone, gravel or slag	2,000	15
1 cement, 2½ sand, 5 broken stone, gravel or slag	1,750	18
1 cement, 3 sand, 7 broken stone, gravel or slag	1,500	20

(See Special Ruling II, Page 295.)

760. **Unit Stresses for Steel and Concrete.)** (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 pounds per square inch.

(c) Shearing stress in steel shall not exceed 12,000 pounds per square inch.

(d) The compressive stress in steel shall not exceed the product of the compressive stress in the concrete multiplied by the elastic modulus of the steel and divided by the elastic modulus of the concrete.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fibre of concrete shall be thirty-five one-hundredths of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds Per Sq. Inch.
On plain round or square bars of structural steel	70
On plain round or square bars of high carbon steel	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1	50
On twisted bars when the twisting is not less than one complete twist in eight diameters	100

(h) For specially formed bars, the allowable unit stress for bond shall not exceed one-fourth of the ultimate bond strength of such bars without appreciable slip which shall be determined by tests made by the person, firm or corporation engaged in such construction work to the satisfaction of the Commissioner of Buildings, but provided that in case shall such allowable unit stress exceed 100 pounds per square inch of the specially formed bars.

761. **Design for Slabs, Beams and Girders.)** Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure shall be applied to beams and members resisting bending.

(b) The adhesion between the concrete and the steel shall be sufficient to make the two materials act together.

(c) The steel to take all the direct tensile stresses.

(d) The stress strain curve of concrete in compression is a straight line.

(e) The ratio of the moduli of elasticity of concrete to steel shall be as specified in the table in Section 759.

(See Special Ruling II and IV, Pages 295-301.)

762. **Moments of External Forces.)** (a) Beams, girders, floor or roof slabs and joists shall be calculated as supported, or with fixed ends, or with partly fixed ends, in accordance with the actual end conditions, the number of spans and the design.

(b) When calculated for ends partly fixed for intermediate spans with an equally distributed load where the adjacent spans are of approximately equal lengths:

Bending moment at center of spans shall not be less than that expressed in the following formula $\frac{WL^2}{12}$ for intermediate spans and $\frac{WL^2}{10}$ for end spans.

(c) The moment over supports shall not be less than the formula $\frac{WL^2}{18}$ and the sum of the moments over one support and at the center of span shall be taken not less than the formula $\frac{WL^2}{6}$.

In the formulas hereinabove given "W" is the load per lineal foot and "L" the length of span in feet.

(d) In case of concentrated or special loads the calculations shall be based on the critical condition of loading.

(e) For fully supported slabs, the free opening plus the depth, for continuous slabs, the distance between centers of supports, is to be taken as the span.

(f) Where the vertical shear, measured on the section of a beam or girder between the centers of action of the horizontal stresses, exceeds one-fiftieth of the ultimate direct compressive stress per square inch, web reinforcement shall be supplied sufficient to carry the excess. The web reinforcement shall extend from top to bottom of beam, and loop or connect to the horizontal reinforcement. The horizontal reinforcement carrying the direct stresses shall not be considered as web reinforcement.

(g) In no case, however, shall the vertical shear, measured as stated above, exceed one-fifteenth of the ultimate compression strength of the concrete.

(h) For T beams the width of the stem only shall be used in calculating the above shear.

(i) When steel is used in the compression side of beams and girders, the rods shall be tied in accordance with requirements of vertical reinforced columns with stirrups connecting with the tension rods of the beams or girders.

(j) All reinforcing steel shall be accurately located in the forms and secured against displacement; and inspected by the representative of the architect or engineer in charge before any surrounding concrete be put in place. It shall be afterwards completely inclosed by the concrete, and such steel shall nowhere be nearer the surface of the concrete than 1½-inch for columns, 1½ inch for beams and girders, and ½-inch, but not less than the diameter of the bar, for slabs.

(k) The longitudinal steel in beams and girders shall be so disposed that there shall be a thickness of concrete between the separate pieces of steel of not less than one and one-half times the maximum sectional dimension of the steel.

(l) For square slabs with two-way reinforcements the bending moment at the center of the slab shall not be less than that expressed in the formula $\frac{WL^2}{24}$ for intermediate spans, and $\frac{WL^2}{20}$ for end spans.

(m) The moment over supports shall not be less than the formula $\frac{WL^2}{36}$ and the sum of the moments over one support and at the center of the span shall be taken not less than the formula $\frac{WL^2}{12}$.

In which above formula "W" is the load per lineal foot and "L" the length of the span.

(n) For squares or rectangular slabs, the distribution of the loads in the two directions, shall be inversely as the cubes of the two dimensions.

(o) Exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and the plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and so secured as to meet the approval of the Commissioner of Buildings.

(p) Shrinkage and thermal stresses shall be provided for by introduction of steel.

(q) In cases which it is claimed that equally good or more desirable system of reinforced concrete not covered by, or varying as to design from the conditions hereinbefore given, he shall present to the Commissioner of Buildings plans and specifications giving in detail the construction and formulas used in his design, and the same to be such that they can be checked properly and kept on record by this bureau. He shall then make a destruction test or present evidence satisfactory to the Bureau that such test has been made, with full particulars of the result of the test. If said test shows that based on the specifications submitted, the construction has a factor of safety of four on total dead and live load and otherwise meets with the approval of the Commissioner of Buildings, the said system of reinforced concrete may be used in accordance with said plans and specifications.

Passed, April 27, 1925.

(See Special Ruling II, Page 295.)

763. **Limiting Width of Flange in "T" Beams.)** (a) In the calculation of ribs, a portion of the floor slab may be assumed as acting in flexure in combination with the rib. The width of the slab so acting in flexure is to be governed by the shearing resistance between rib and slab, but limited to a width equal to one-third of the span length of the ribs between supports and also limited to a width of three-quarters of the distance from center to center between ribs.

(b) No part of the slab shall be considered as a portion of the rib, unless the slab and rib are cast at the same time.

(c) Where reinforced concrete girders support reinforced concrete beams, the portion of floor slab acting as flange to the girder must be reinforced with rods near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams.

(See Special Ruling IV, XVII, Page 301-305.)

764. **Reinforced Concrete Columns—Limit of Length—Per Cent of Reinforcement—Bending Moment in Columns—Tying Vertical Rods.)** (a) Reinforced concrete may be used for columns in which the concrete shall not be leaner than a 1:2:4 mixture and in which the ratio of length to least side or diameter does not exceed twelve, but in no case shall the cross section of the column be less than 64 square inches. Longitudinal reinforcing rods must be tied together to effectively resist outward flexure at intervals of not more than twelve times least diameter of rod and not more than 18 inches. When compression rods are not required, reinforcing rods shall be used, equivalent to not less than one-half of one per cent of the cross sectional area of the column; provided, however, that the total sectional area of the reinforcing steel shall not be less than one square inch, and that no rod or bar be of smaller diameter or smaller least dimensions than one-half inch. The area of reinforcing compression rods shall be limited to three per cent. of cross sectional area of the column. Vertical reinforcing rods shall extend upward or downward into the column, above or below, lapping the reinforcement above or below enough to develop the stress in rod by the allowable unit for adhesion. When beams or girders are made monolithic with or rigidly attached to reinforced concrete columns, the latter shall be designed to resist a bending moment equal to the greatest possible unbalanced moment in the beams or girders at the columns, in addition to the direct loads for which the columns are designed.

(b) When the reinforcement consists of vertical bars and spiral hooping, the concrete may be stressed to one-fourth of its ultimate strength as given in Section 759, provided, that the amount of vertical reinforcement be not less than the amount of the spiral reinforcement, nor greater than eight per cent. of the area within the hooping; that the percentage of spiral hooping be not less than one-half of one per cent. nor greater than one and one-half per cent.; that the pitch of the spiral hooping be uniform and not greater than one-tenth of the diameter of the column, nor greater than three inches; that the spiral be secured to the verticals at every intersection in such a manner as to insure the maintaining of its form and position, that the verticals be spaced so that their distance apart, measured on the circumference be not greater than nine inches, nor one-eighth the circumference of the column within the hooping. In such columns, the action of the hooping may be assumed to increase the resistance of the concrete equivalent to two and one-half times the amount of the spiral hooping figured as vertical reinforcement. No part of the concrete outside of the hooping shall be considered as a part of the effective column section.

765. **Structural Steel Columns.)** When the vertical reinforcement consists of a structural steel column of box shape, with lattice or battenplates of such a form as to permit its being filled with concrete, the concrete may be stressed to one-fourth of its ultimate strength as given in table in Section 759, provided that no shape of less than one square inch section be used and that the spacing of the lacing or battens be not greater than the least width of the columns.

(See Special Ruling X, Page 303.)

766. **Curtain Walls in Skeleton Construction Buildings.)** Buildings having a complete skeleton construction of steel or of reinforced concrete construction, or a combination of both, may have exterior walls of reinforced concrete eight inches thick; provided, however, that such walls shall support only their own weight and that such walls shall have steel reinforcement of not less than three-tenths of one per cent in each direction, vertically and horizontally, the rods spaced not more than twelve-inch centers and wired to each other at each intersection. All bars shall be lapped for a length sufficient to develop their full stress for the allowable unit stress for adhesion. Additional bars shall be set around openings,

the verticals wired to the nearest horizontal bars, and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars. The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured so as to resist a pressure of thirty pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

767. **Bending and Elongation of Steel.)** The bending and elongation of steel used in reinforced concrete construction shall conform to the following requirements: (a) Steel having a diameter of three-fourths of an inch or less shall be capable of bending cold ninety degrees over a diameter equal to twice the thickness of the piece without fracture; steel over three-fourths inch in diameter shall be capable of bending cold to ninety degrees over a diameter equal to three times the diameter of the piece.

(b) The material of reinforcement shall be such form that it will not elongate under working stress to exceed one fifteen-hundredth.

(c) Reinforcing steel used in reinforcing concrete construction shall not be painted, but shall be free from all mill scale and loose rust.

768. **Cement Tests.)** (a) Only Portland cement shall be used in reinforced concrete construction. All cement shall be tested in car load lots when delivered, or in quantities equal to the same. Cement failing to meet the requirements of accelerated test shall be rejected.

(b) Pats of neat cement must be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, and above boiling water, in a loosely closed vessel for three hours, after which before the pat cools, it is placed in the boiling water for five additional hours. To pass this test satisfactorily, the pat shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

(c) Portland cement when tested shall have a minimum tensile strength as follows: Neat cement after one day in moist air shall develop a tensile strength of at least 200 pounds per square inch; after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch, and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of sand shall after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch; and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 240 pounds per square inch.

(d) A certificate that the cement used has been tested and has met the requirements of this section and that the tests have been made in accordance with the standard specifications and tests for Portland cement as adopted by the American Society for Testing Materials, and by the United States Government adopted 1904; revised 1908, 1909, 1917 and 1921—serial designation C 9-21, shall be furnished by the architect or engineer in charge to the Commissioner of Buildings.

769. **Sand.)** The sand to be used for concrete shall be clean, hard, coarse sand, of the grade known as torpedo sand, and free from loam or dirt, not less than 45 per centum shall be returned on a screen of 400 mesh to the square inch.

770. **Stone.)** The stone to be used in concrete shall be clean crushed hard stone or clean crushed blast furnace slag or gravel of a size to pass through a one-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using. If slag is used, it shall be of such character that when made into concrete the concrete will develop a crushing strength equal to that specified for stone or gravel concrete.

771. **Mixing.)** All concrete shall be mixed in a mechanical mixer except when limited quantities are required, or when the conditions of the work make hand mixing preferable; hand mixing to be done only when approved by the Commissioner of Buildings. In all mixing, the separate ingredients shall be measured and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing.

772. **Placing Concrete.)** In filling in concrete around reinforcing steel, the concrete must be worked continuously with suitable tools, as it is put in place. Filling the forms completely and puddling afterward will not be permitted. In placing the concrete, the work shall be so laid out that partly set concrete will not be subjected to shocks from men wheeling or handling material over it.

773. **Concrete Placed in Freezing Weather.)** When concreting is carried on in freezing weather, the material must be heated, and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand, or stone depending on hot water used in mixing to thaw it out will not be permitted. All reinforced concrete shall be kept at a temperature above freezing for at least forty-eight hours after being put in place. All forms under concrete placed in freezing weather shall remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

774. **Concrete Placed in Warm Weather.)** Concrete laid in warm weather shall be drenched with water twice daily, Sunday included, during the first week after being put in place.

775. **Cement Finish.)** Cement finish added to the top of slabs, beams, or girders, shall not be calculated in the strength of a member unless laid integrally with the rough concrete. No greater unit stress shall be allowed on such cement finish than on the rough concrete.

(See Special Ruling IV, Page 301.)
(See Special Ruling IX, Page 303.)
(See Special Ruling XV, Page 305.)

776. **Fireproof Concrete Construction—Acceptance.)** Reinforced concrete construction will be accepted for fireproof buildings if designed as prescribed in this paragraph. The aggregate for such concrete shall be clean, broken stone or clean crushed blast furnace slag, or clean screened gravel, together with clean, coarse sand of the grade known as torpedo sand; stone, slag or gravel shall be of a size to pass through a screen of three-quarter inch square mesh. The minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be two inches on the bottom, and one and one-half inches on the sides of said beans and girders. The minimum thickness of concrete under slab rods shall be one inch; and all reinforcement in columns shall have a minimum protection of two inches of concrete except as hereinafter provided, if a supplementary metal fabric is placed in the concrete surrounding the reinforcing, simply for holding the concrete,

the thickness of concrete under the reinforcing may be reduced by one-half inch, then such fabric shall not be considered as reinforcing metal.

777. **Removal of Forms.)** In no case shall the props and shores used in reinforced concrete construction be removed from under floors and roofs in less than two weeks, except as is provided herein. Column forms shall not be removed in less than four days. The centering from bottom of slabs and sides of beams and girders may be removed after the concrete has set for one week, if the floor has obtained sufficient hardness to sustain the dead weight of the said floor. No load or weight shall be placed on any portion of the construction until the concrete has fully set and the centers have been removed.

778. **Tests.)** The contractor for the reinforced concrete construction shall make load tests on any portion of the work within a reasonable time after erection, as may be required by the Commissioner of Buildings. Such tests must be made under the direction of the Commissioner of Buildings in his presence or in the presence of his representative, and must show that the construction will sustain a load twice the sum of the live and dead loads for which it was designed, without any sign of failure. The construction may be considered as part of the test load. Each test load shall cover two or more panels and shall remain in place at least twenty-four hours. The deflection under the full test load at the expiration of twenty-four hours shall not exceed one eight-hundredth of the span. These tests shall be considered as tests of workmanship only.

779. **Reinforced Terra Cotta Hollow Tile.)** (a) The term reinforced hollow tile is hereby defined to mean a system of hollow burned clay tile in combination with reinforced concrete, in which combination the hollow tile may be used to resist compressive and shearing stresses subject to the following provisions:

The provisions relating to reinforced concrete construction shall hold as far as applicable to this system.

All tile to be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having an ultimate compressive strength of not less than 4,000 pounds per square inch of net area of surface tested.

The following stresses and values shall not be exceeded: Extreme fibre stress (compressive) on hollow tile, 500 pounds per square inch.

Shearing stress on hollow tile, forty pounds per square inch.

Adhesion between tile and 1:2:4 concrete or 1:3 cement mortar, twenty pounds per square inch.

Ratio of modulus of elasticity of steel to that of tile with cement mortar joints, 10.

(b) The hollow tile shall be thoroughly soaked with water at the time concrete is poured and be kept drenched for at least thirty-six hours afterwards. The joints between tiles shall be staggered, buttered and slushed full of mortar consisting of one (1) part of Portland cement and three (3) parts of clean, sharp sand, thoroughly mixed.

(c) Columns of solid terra cotta or of hollow terra cotta in which the sectional area of the open holes in each block shall not exceed twenty (20) per cent of the gross sectional area of such block, may be used for structural purposes provided the height of such column shall not exceed twelve times the least dimension.

The allowable stress shall not exceed 350 pounds per square inch and shall be subject to the reduction formula given in Section 746 in paragraph f.

All terra cotta tile used for construction of columns shall be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having ultimate compressive strength of not less than 6,000 pounds per square inch of net area of cross section of samples tested.

Mortar used in setting terra cotta tile walls and columns to be composed of one (1) part Portland cement and three (3) parts clean, sharp sand, thoroughly mixed.

(d) All terra cotta tile must be thoroughly wet before using and when used in columns must be set on end with the voids running vertically and directly over each other, and with the webs in direct line of pressure.

All vertical joints must stagger and terra cotta blocks must be of proper dimensions to meet this condition as no broken tile will be allowed.

All work to be set plumb, with uniform horizontal joints, thickness to average three-eighths (3-8) of an inch. The minimum time which shall elapse between the finishing of the work and before any load is placed thereon shall be not less than seven days.

(e) Hollow tile may be used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as partition walls, provided the proportion between thickness of wall and free height between the floors does not exceed fifteen (15) and the load including the weight of the construction does not exceed three hundred and fifty (350) pounds per square inch of net sectional area of tile, and shall be of the thickness specified by this chapter for brick walls. Hollow terra cotta tile may be used for exterior walls, but when so used the thickness and height of the work must conform to the dimensions required for brick walls in this chapter, but must in no case exceed four stories in height in any building. The thickness of walls shall be calculated as the outside dimensions of the tile and each tile shall be full thickness of wall. The thickness of the plastering is not to be included as a part of the thickness of the wall. Walls having a thickness of 4 inches may be used when the height does not exceed five (5) feet. The quality and gross sectional area of the tile and mortar and special provisions as to workmanship as specified for terra cotta columns shall apply to terra cotta tile walls.

(f) Fireproof storage bin, grain elevators and grain warehouses may be built in cylindrical form with terra cotta tile of such height, diameter and thickness as is allowed by safe engineering practices, provided that the material shall not be stressed in excess of the limits prescribed in this chapter for walls and columns.

(See Special Ruling XI, Page 305.)

780. **Cinder Concrete.** (a) Cinder concrete construction may be used for all buildings in which fire-proof construction is mandatory by this chapter, or where ordinary construction, mill construction or slow-burning construction may be used.

(b) Only clean, thoroughly burnt, steam boiler cinders, free from matter other than cinders may be used. The cinders used shall be of such size that they will pass through a one-inch square mesh. Cinder concrete piers or walls shall not be permitted to carry loads and shall not be given credit therefor.

(c) The ultimate compressive strength per square inch of cinder concrete shall be taken as not exceeding seven hundred pounds. The ratio of the modulus of elasticity of steel divided by the modulus of elasticity of cinder concrete shall be taken as thirty.

(d) There shall not be less than one part of Portland cement to seven parts of

cinders and sand of the grade known as torpedo sand in cinder concrete. All other special requirements and methods of calculation for reinforced concrete as required in this chapter shall modify and regulate the use of cinder concrete in buildings.

(e) All steel and all metal pipe and conduits enclosed in cinder concrete shall be protected by a coating of cement grout or plastered with good lime mortar before the cinder concrete is placed.

(f) For fireproof construction, the minimum thickness of cinder concrete covering on structural metal shall be the same as required for brick or concrete covering for fireproof buildings by this chapter. In slow-burning or mill construction buildings, the minimum thickness of cinder concrete covering on structural metal shall be three inches on columns and two inches on beams, girders and other structural steel or iron members.

(g) Wherever cinder concrete is used for the covering of columns, beams, girders or other structural steel members of a building the cinder concrete covering shall have metal binders, or wire fabric, imbedded in and around said columns, beams, girders or other structural steel members. If wire is used for said metal binders, it shall not be smaller than No. 8 gauge wire and shall be spaced not less than sixteen inches apart along the length of the steel member covered.

(h) Where cinder concrete construction is used for a building which, by this chapter, is required to be of fireproof construction, all parts that carry weights or resist strains, shall be made entirely of incombustible material, and all metallic structural members shall be protected against the effects of fire by cinder concrete proportioned, mixed, applied and secured as herein described.

(i) All other parts of a building of cinder concrete construction, built where fireproof construction is mandatory by this chapter, shall be built and made of the material required by this chapter for buildings of fireproof construction; provided, however, that cinder concrete as described herein, and of the same thickness elsewhere specified, may be used for all protective covering of structural metal, after such metal has been protected by a coating of cement grout or plastered with good lime mortar, as required by this chapter.

Skeleton Construction.

(See Special Ruling I, Page 295.)

781. **Skeleton Construction.)** (a) The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and stresses are transmitted from the top of the building to the foundations by a skeleton or framework of metal or reinforced concrete.

(b) In metal frame skeleton construction the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than ¾ inch in diameter, and the beams and girders shall be bolted to the columns. Bolt holes in flanges for connection from column to column shall be drilled. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

(c) All steel trusses shall be riveted and the steel work in buildings more than 100 feet high and in a building whose height exceeds twice its width shall be riveted.

(d) Wherever it is found impossible to rivet connections as herein described and such connections are bolted, cold rolled or turned bolts of exact fit and diameter in reamed holes may be used in place of rivets with the same allowable stresses as field driven rivets.

(e) All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

(f) After the bases or base plates and columns have been set in place, both shall be protected by a covering of cement concrete applied direct to the metal, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

(g) All metal shall be clean and shall be free from loose rust and scale, and all metal except that to be embedded in concrete shall be protected with at least two coats of metal protecting paint.

(h) All structural details and workmanship shall be in accordance with accepted engineering practice.

(i) All trusses shall be held rigidly in position, both temporarily and permanently by efficient lateral and sway bracing.

Miscellaneous Provisions.

782. **Porches—Verandas—Porticos—Construction of Inside Fire Limits.)** (a) The enclosing walls of porches, verandas, or porticos shall be of incombustible material on buildings inside the fire limits, except that where such porches, verandas, or porticos constitute part of a storm house or of a storm door enclosure, they may be of combustible material, provided, that they be not more than twelve feet high, nor occupy a greater frontage than two feet more than the width of the inner doors protected by such storm enclosure.

(b) On buildings more than three stories in height, porches hereafter erected, if of combustible material, shall not exceed one story in height. Where porches of incombustible material are continuous and extend fifty feet or more across the rear of buildings, there shall be a partition of incombustible material separating each fifty feet of porch from the adjacent porch.

(See Special Ruling XII, Page 305.)

783. **Tanks on Roofs—Permits—Fees.)** It shall be unlawful for any person, firm or corporation to construct, maintain or allow, or permit to remain in or upon the roof of any building in the city, any tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction. No tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first submitting for the approval of the Commissioner of Buildings a complete set of plans, showing the construction in detail of the supports and foundations of such tank. If such plans shall be satisfactory to the Commissioner of Buildings, they shall be approved by him. The owner or his agent or the contractor erecting such tank shall, before proceeding with the erection of such tank, procure from the Department of Buildings a permit for the sub-structure work, for which permit a fee of five dollars shall be charged.

784. **Door and Window Openings, When Protected in Buildings of Classes I, II, IV,**

V, VII and VIII—Iron Doors—Wired Glass Set in Metal Frames.)

(See Illustration, Sec. 470b).

(a) Where the distance from door to window openings in buildings of Classes I, II, IV, V, VII and VIII is less than thirty (30) feet from the opposite side of the established alley line and where the windows and doors of two or more areas of the same building which is required to be separated by dividing walls by this chapter, are on a court, every such window and door, distant less than thirty feet from another window or door of another such area and also where the doors and window openings are within fifteen (15) feet of an inside lot line, such openings shall be provided with windows and doors constructed of wire glass set in metal frames and sash; provided, further, that doors may be automatic rolling steel shutters or steel plate doors or metal-clad wood doors, and further provided that at least one of the first or ground floor doors must be a swinging door.

(b) Where iron doors are used to fulfill the requirements of this section they shall be made of sheet iron or steel, of not less than No. 14 U. S. gauge metal, and shall lap the wall at least one-half inch all around the opening, and the bottom shall fit the sill closely where it is not practicable to lap it. The frames and crossbars shall be made of one and one-half by one and one-half by one-fourth inch angles and in no case shall there be less than two crossbars, and where the doors are over six feet high, such crossbars shall be placed not more than two feet apart. Lever bars shall be made of one and one-half by three-eighths inch iron, extending at least one-third of the distance across the opposite leaf. The number and spacing of such lever bars shall be the same as the crossbars. Where hinges are used they shall be made of two by one-fourth inch iron, extending at least three-fourths of the way across the door. The number and spacing of such hinges shall be the same as is required for the crossbars. Pin bolt or eyes shall be one-half inch round and shall be securely fastened to the building.

(c) Where metal frames, metal sash and wired glass are used to fulfill the requirements of this section, the glazed portion of the frames and sash shall be set with fire-resisting glass such as is elsewhere herein defined. The glass must be supported by frames and sash and shall be retained by the structural part of the frame or sash independently of the material used for waterproofing purposes. Non-inflammable material only shall be employed for the structural members used for retaining glass in the sash. Frames and sash shall be made of sheet metal or of rolled steel sections. Frames shall be of such form as to be retained in the wall opening either with flanges of at least one and one-half inches in width or by fixed anchors of proper length spaced not exceeding twenty-four inches securely set into the wall. Sheet metal frames and sash shall be made of galvanized iron of not less than No. 24 gauge and of a quality soft enough to permit of necessary bending without breaking, or of not less than 20-ounce copper, or other metal of equal strength and durability and which will not melt at a lower temperature than copper. All joints shall be made with interlocking seams, securely riveted together, and in no case shall solder be used for other than weather-proofing purposes. The head of the frame shall be closed at the top and the piece forming this closure shall be securely fastened to each side at all points. The sill shall be filled with concrete or other incombustible material. Movable or sliding sheet metal sash shall have stiles and rails of thickness and of width at least one and three-quarter inches respectively, and shall be securely fastened together at each corner and so constructed that they will correspond with the construction of the frames at every place of contact. Where frames are made of solid rolled steel sections the metal shall be not less than one-eighth inch in thickness securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to withstand shipment, handling and installation without distortion. Where sashes are made of solid rolled steel sections the metal shall not be less than one-eighth inch in thickness excepting the removable members for retaining the glass and the weathering strips which shall not be less than one-sixteenth inch in thickness. The sash members shall be securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to safely withstand the stresses occasioned by handling, installation, operation and by wind pressure. Frames and sash in the construction of which solid rolled steel section members are used shall have all their parts protected from the effects of rust and corrosion by a covering of durable enamel or by the application of two coats of approved mineral paint. All glazing of frames or sash shall be with wired glass at least one-quarter inch in thickness. The exposed area of any single pane or light of glass measured on the inner side of the window shall not exceed seven hundred and twenty (720) square inches nor shall the width or length of any pane or light of glass exceed forty-eight (48) inches. Glass shall be held in position by a metal ledge on each side of same. Ledges on the back or inner side of the glass shall be at least three-quarter inches high for lights where the unsupported glass area is seven hundred and twenty (720) square inches and for glass of an unsupported area of less than seven hundred and twenty (720) square inches a reduction in height of the inside ledges may be made at the rate of one-sixteenth inch for each one hundred (100) square inches reduction of unsupported glass area, but in no case shall the height of the inside ledges be less than one-half inch. The ledges on the outer or weather side of the glass shall not be less than one-half inch in height for unsupported glass areas in excess of three hundred and fifty (350) square inches. For unsupported glass areas less than three hundred and fifty (350) square inches, the weather side ledge may be one-half the height of the inside ledge but in no case shall it be less than one-quarter inch high. Clearance between the edge of the glass and the bottom of the groove formed by the ledges shall not exceed one-eighth inch and all glass shall be set in suitable putty. Movable sash shall have stiles and rails so constructed that they will properly engage with the frame members at all points of contact, afford ample weather-proof qualities and not warp or bulge materially under heat or rapid cooling.

(d) Lifting or sliding sash shall be counter-weighted so as to balance and if double-hung the sash weights shall be separated by parting strips in the weight boxes and the weights shall be accessible through the boxes. Such sash shall be provided with metallic sash chain, cord or tape, and smooth running sash pulleys securely riveted or bolted in place. The sash chain, cord or tape shall be of sufficient strength to withstand severe heat without parting and be thoroughly protected against moisture or corrosion. Sash shall be fitted into frame with suitable stops and parting beads of metal or their equivalent. Sash shall be removable. Meeting rails of the sashes shall be so constructed as to prevent the passage of heat and flame and shall be equipped with one or more substantial sash locks securely riveted or bolted in place.

(e) Horizontally pivoted sash and movable sash shall be provided with steel pivots at least three-eighths inches in diameter securely attached above the middle. Pivots shall work in substantial iron or steel eye

plates bushed with brass and securely attached in place. Sheet metal frames shall be reinforced where the pivots enter by riveting on one-eighth inch iron strips so drilled as to receive the pivots. Such sash must be provided with suitable stops and an effective attachment for holding them open or closed and with such substantial gravity locks or ledges that will be positive in action and hold the sashes tightly closed when exposed to heat. Where either sash is stationary or where two pivoted sashes are used the transom bar dividing such sash shall be so constructed that it will not warp or bulge materially under heat or rapid cooling. Rails or transom bars where used shall be made so as not to be easily affected by rust and to afford ample weatherproof qualities.

(f) Vertically pivoted sash shall comply generally with the requirements for horizontally pivoted sash and movable sash. They must be constructed in such a manner as to afford proper stiffness and so as to prevent material warping or bulging under heat or rapid cooling.

(g) Hinged sash or casement windows must be hinged with substantial iron or steel hinges securely bolted or riveted in place, and provided with substantial iron or steel latches or locks securely fastened in place. Such sash shall be constructed so as to fit the frame closely and afford ample weatherproof qualities at all points. It shall be provided with stops and fastenings that will prevent material warping or bulging under heat or rapid cooling.

(h) Where the area of wall openings is in excess of 5 feet by 9 feet, the metal frames containing the sash or glass must be reinforced at every point of division by not less than five-inch "I" beams securely fastened into the brickwork, proper allowance being made for expansion of the beams when heated. "I" beams shall be protected on the flanges with at least two inches of tile, concrete, or other material approved by the Commissioner of Buildings, and next to the web with at least two and one-half inches of such material, which thickness shall be increased on large beams. Metal frames shall be securely attached to the reinforcing members.

(i) Electro-glazed prism glass may be used in lieu of wired glass, when approved by the Commissioner of Buildings as to material and construction of same, providing the frames and sash of same comply with the requirements of this section for wired glass window frames and sash.

(j) In cases in which it is claimed that equally good or more desirable mode or manner of constructing and installing metal frames, metal sash and fire-resisting glass, other than specified in this chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings upon written application to him for a permit to use the same, shall cause a test to be made of such construction in a laboratory of recognized standing, and may appoint an architect or a fire prevention engineer to represent the City at such test. A requirement of testing said frame and sash shall be that it will be capable of withstanding exposure to fire on the weather side for one hour with temperatures rising gradually to at least fifteen hundred (1500) degrees Fahr. without loss of glass or material passage of flame, and immediately after exposure to such before-described fire conditions it shall be required to withstand application to the weather side of a stream of water at least seven-eighth inches in diameter applied from a distance of twenty feet at sixty (60) pounds pressure. The results of the test shall show also that the proposed material and construction will be equal or better in fire-resisting and structural qualities to a frame and sash of dimensions not greater than five feet by nine feet built as per requirements of this section. All expenses of this test shall be borne entirely by the applicant for such permit. In the event of such examination and test being satisfactory to the Commissioner of Buildings he shall authorize the use of such frames and sash as a compliance with this section.

(k) This section shall not apply to frame buildings nor to buildings outside the fire limits twenty-eight hundred square feet or less in area, nor to buildings of Class I, one story in height, nor to buildings of Class II not more than two stories in height, nor to store windows in the first story, where the same are located on an alley and not more than sixteen feet from the street.

785. **Window and Door Sills—Columns and Lintels Supporting Store Fronts—Incombustible.)** (a) For buildings other than frame buildings window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this Chapter, be counted incombustible.

(b) In buildings other than frame and excepting buildings of Classes III and VI, lintels shall be of incombustible material; provided that in one-story store front buildings columns and lintels may be of combustible material.

786. **Courts and Light Shafts in Buildings.)** (a) Every court or light shaft of every building shall be open and unob-

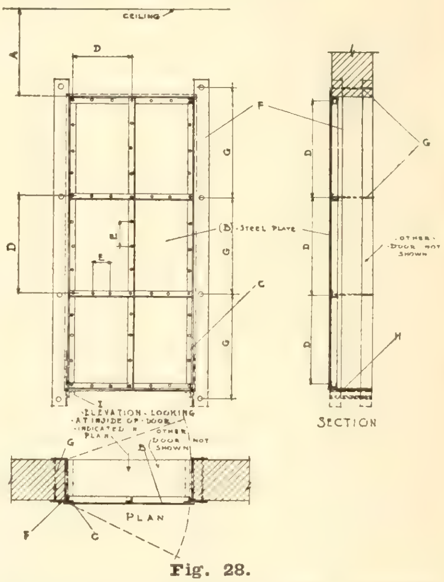

Fig. 28.

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED.

Section 789c, f.

(A) Distance to ceiling.

If A is less than 3′ 0″ fusible link at ceiling may be omitted.

(B) Steel plate, No. 12 U. S. gauge or greater.

(C) Continuous 2″ x 2″ x ⅜″ Ls.

(D) 2 x 2 x ⅜″ Ls forming panels. Angles not less than 2′ 0″ apart.

(E) Rivets spaced from 4″ to 6″ o. c.

(F) Door frames 3 x 4 x ⅜″ Ls (or alternate as by ordinance).

(G) ¾″ bolts, not more than 2′ 0″ o. c. fastening frame to wall.

(H) ¼″ iron or steel sill required.

(I) Sill fastened to frame by 1½ x 1½ x ¼″ Ls on inner side of frame. (Sec. 789f).

Exception: Sill plates may be omitted where floors are of concrete construction.

structed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors, with the glazed portions thereof of wired glass.

787. **Bay Windows—Light Courts—Shafts—Construction of.)** (a) The walls of every bay window and every court in every masonry constructed building, except buildings of Class III, shall be built of brick or other fireproof construction throughout as required for exterior walls.

(b) The walls of every vent shaft of every masonry constructed building, except buildings of Class III, shall be built of masonry or a fireproof material not less than four inches in thickness supported by steel or iron.

(c) Every court, light shaft, or vent shaft in every building shall be open and unobstructed from the bottom of such court to the sky with the exception that fire escapes may be built in courts or light shafts, subject to all the provisions of this Chapter.

(d) All windows, doors, or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors with the glazed portion thereof of wired glass.

788. **Windows, Cleaning of—Safety Devices.)** The owner or agent of every building in the city shall equip each and every window in any such building above the first story thereof with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building above the first story without danger to the person cleaning such windows, and such devices shall be of such pattern and construction as will reasonably and safely answer the purposes for which they are intended; provided, however, that if windows are of such construction that they may be easily cleaned from the inside they need not be equipped with such devices.

(See Illustration, Sec. 740b).

789. **Dividing Walls and Iron Doors—Openings Inserted.)** (a) Wherever openings are to be inserted in dividing walls in buildings, where such dividing walls are required by reason of the large area of such building, or in dividing walls between two or more connected or attached buildings, they shall be provided with incombustible doors as follows:

(b) Such doors may be either sliding doors or swinging doors, and shall be so constructed, installed and maintained that they can be easily opened or closed from either side at all times by any person; provided, however, rolling steel shutters may be used when such openings are not used as exits.

(c) Every such door shall be equipped with a device containing a fusible link or other releasing arrangement of equal efficiency, approved by the Commissioner of Buildings. There shall be one of these immediately above the door opening and one above the opening near the ceiling. Where the ceiling is less than three feet above the door opening, the last mentioned fusible link or releasing device may be omitted, if the doors are so arranged that the operation of any one of the thermostats, or other releasing devices, will result in the closing of the doors on both sides of the walls. Fusible links, or other approved substitute, shall be made so that they will fuse or operate when subjected to a heat of 160 to 165 degrees Fahrenheit. If said doors are of steel plate, the plate or plates shall be of No. 12 U. S. gauge or greater thickness, with a continuous two by two by three-eighths inch angle iron frame extending all around the same and two by two by three-eighths inch panel bars not exceeding twenty-four inches apart, riveted to the plate of the door with not less than three-eighths inch rivets spaced four inches to six inches between centers. Pairs of swinging doors shall be so constructed that when the doors are closed, they will be of strength equal to that of a single door, and shall be so arranged that they will operate automatically. All doors shall be hung on wall frames of four by three by three-eighths inch angle iron or of four by three-eighths inch bar iron stiffened by one and one-half by one and one-half by one-fourth inch angles riveted on the back and fitting snugly to the wall. The frame shall be fastened together by three-fourths inch bolts extending through the wall, such bolts being not more than two feet apart. All doors to be made to fit closely to the wall frame on all sides. Lintels of door openings shall be made of brick, iron or concrete.

(d) Swinging iron doors shall swing on three wrought iron hinges made of two by three-eighths inch bar iron and shall be secured by at least three lever bars of one and one-half by three-eighths inch iron, working together and so arranged as to be operated on either side of the door.

(e) Sliding iron doors shall slide in channels at the top and bottom; bottom

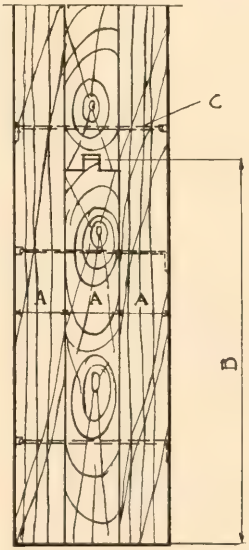

Fig. 29. **Fig. 30.** **Fig. 31.**

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED—(Continued).

Section 789j.

Fig. 29. Tin-clad Doors.
(A) Three thicknesses of 13/16″ required.
(B) Boards not wider than 8″. Outside layers vertical and inside layer horizontal laid.
(C) Nails clinched as (C).
Fig. 30. Single locked tin plate seam.
Fig. 31. Double locked tin plate seam.

channels shall be formed by two angles two and one-half by three-eighths inch and one and one-half by one-fourth inch; top channels to be formed by two angles two by three-eighths inch and one and one-half by one-fourth inch; channels shall be securely

riveted or bolted through the wall frame and where they extend beyond the wall frame shall be firmly bolted to the wall by expansion bolts. Track shall be without incline, of one-half by one-half inch iron securely riveted on the upper side of the angle iron channel. Hangers shall be of the anti-friction pattern and securely fastened to the door plate by at least four one-half inch bolts. Wheels shall be of cast iron three-fourths by four and one-half inches.

(f) Sills between iron doors shall be of one-fourth inch iron or steel with edges securely fastened to one and one-half by one and one-half by one-fourth inch angle iron or heavier, on the inner side of the wall frame. Where adjoining floors are of concrete construction, sill plates may be omitted.

(g) When tin-clad doors are used they shall be made of three thicknesses of thirteen-sixteenths inch seasoned, non-resinous wood, of good sound quality, free from sap and large or loose knots, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The outside layers shall be vertical, the inside layer

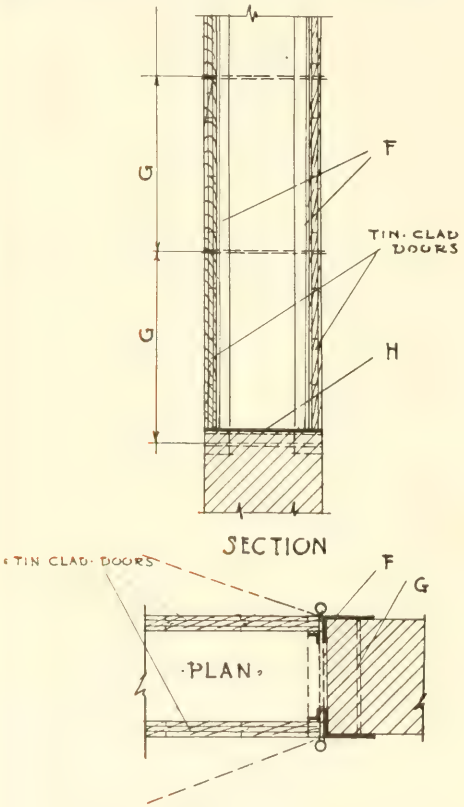

Fig. 32.

Section 789g.

Fig. 32. (H) ¼ inch iron or steel sill.
(F) 3″ x 5″ x ¾″ L riveted to iron sill.
(G) ¾ inch bolt 18″ o. c.
Exception: Sill plates may be omitted where floors are of concrete construction.

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shall be horizontal; layers shall be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to leave smooth surfaces. The woodwork shall be thoroughly covered with terne plate tin of size fourteen by twenty inches, weighing not less than one hundred and thirteen pounds per box of one hundred and twelve sheets; all joints shall be locked one-half inch and nailed under seams, except on edges of door; vertical joints shall be double locked, horizontal joints single locked. Nails used to fasten tin shall be No. 13 gauge, flat head, full barbed wire, two inches long.

(h) Swinging tin-clad doors shall have three-eighths by two and one-half inch wrought iron hinges bolted to doors with four three-eighth inch bolts. Doors in excess of seven feet in height shall be provided with three hinges and have wrought iron wall eyes built in wall, or riveted to wall frame, or bolted through wall with three-fourth inch bolts. They shall have at least three level bars of one and one-half by three-eighths inch iron, working together; the latch shall be placed so it can be operated from either side of the door and provided with proper keepers bolted through the door, with the spring to insure latching; catches shall be made of one-half inch wrought iron securely bolted to wall or wall frame.

(i) Sliding tin-clad doors shall have tracks inclined three-fourths inch to the foot, made of three and one-half by three-eights iron rolled steel, or round bars, or round pipes of equal strength, securely bolted through wall with three-fourths inch bolts. Hangers shall be made of three-eighths by three and one-half inch wrought iron attached by not less than one-inch bolts. Wheels shall be of malleable or wrought iron with not less than one and one-half inches bearing on axle. Doors over six feet wide shall have three hangers and shall be provided with necessary binders, chafing strips, bumpers and bumper shoes.

(j) Sills between tin-clad doors shall be of one-fourth inch iron or steel riveted to a three and one-half by five by three-eighths inch angle iron on each side of the wall; angle irons to be fastened together through the wall by three-fourths inch bolts spaced not to exceed eighteen inches apart; provided, that where adjoining floors are of concrete construction, sill plates may be omitted.

(k) Rolling steel doors used as dividing wall doors shall be made either of wooden slats covered with steel or bronze, or of number 20 U. S. gauge painted steel, or of number 24 U. S. gauge galvanized steel. The edges of such doors shall run in steel channels not less than one and one-half inches deep, and three-sixteenths of an inch in thickness.

(l) Such doors shall be hung on winding shafts and helical springs of sufficient strength to counterbalance the door at any position, and shall be equipped with a device to hold the doors in a closed position if the spring is destroyed. The head of the door opening shall have baffle plates of number 12 U. S. gauge steel, which shall be reinforced around the edges by one and one-half inch angles, to act as fire and smoke stops. The openings for such doors shall have steel frames and sills as herein required for steel swinging doors.

(m) Wherever incombustible doors are to be used in openings to vertical shafts for stairways, passenger and freight elevators, pipes, conduits, and in corridor and room partitions, they may be made of two thicknesses of wood and covered with tin as described in paragraph (g) of this section, or of No. 20 U. S. gauge steel with stiles and rails not less than one and three-fourths inch and panels one-quarter inch thick, and the interior of said doors shall be filled with asbestos or non-resinous wood; provided however, that in fireproof buildings of Classes IIa, IIb, III, except when used in part as

a stable and garage, IV, VI, and VIII, and in fireproof buildings of Class I, when equipped with an automatic sprinkler system, and when the occupancy does not constitute a special fire hazard in the opinion of the Chief of Fire Prevention and Public Safety, these openings, with the exception of openings to freight elevators, may be provided with incombustible doors consisting of a structure of clear, non-resinous wood not less than one and five-eighths inch thick assembled in the form of a core and protected on all surfaces with a pure long fibre asbestos fabric, weighing one and twenty-eight one-hundredths ounces per square foot, or other protective coating equally as incombustible and mechanically bonded therewith and veneered, or consisting of a structure of clear, non-resinous wood with panels not less than three-quarters inch thick and stiles and rails not less than one and five-eighths inch thick assembled in the form of a core and covered on all surfaces with an asbestos fabric and sheet steel, copper or bronze; provided, further, that nothing contained in this paragraph shall be construed as prohibiting the use of such incombustible doors as are described in paragraphs (c), (g) and (k) of this section and paragraph (b) of Section 784. The frames and trim shall be of materials as herein described.

(n) No glass panels shall be permitted in incombustible doors, except that in fireproof buildings of Classes I, IIa, IIb, III except when used in part as a stable or garage, IV, VI and VIII, doors to passenger elevators, stairs, halls. courts, fire escapes, corridor and room partitions, wired glass panels may be used not exceeding one thousand four hundred forty square inches in total area, no division of which shall exceed 720 square inches in area and no dimension of which shall exceed forty-eight inches in extent. Where an elevator or stairway is enclosed with incombustible partitions and doors for the purpose of obtaining credit for additional exits, no glass of any kind shall be permitted in these partitions or doors.

790. **Metal or Reinforced Concrete Chimneys in Fireproof Buildings—Air Space.)** (a) Internal chimneys of rolled steel or iron may be built in buildings of fireproof construction, provided that the rolled steel shall be not less than three-eighths inch in thickness, except that the upper fifty feet of such chimney may be one-quarter of an inch in thickness, riveted in every joint, or of cast iron, providing same shall not be less than three-fourths inch in thickness and jointed by bell and spigot joints or flanged bolted joints. All joints in cast iron work shall be filled and pointed with fire clay. Such metal internal chimneys shall be securely and firmly anchored to the framing of such fireproof building at each floor line and at the roof. The lower part of each such chimney shall be lined with insulating lining for a height herein required for the respective area by Section 794 of this Chapter. The insulating lining shall be one of the linings described in Section 796 of this Chapter.

(b) Reinforced concrete not less than four inches in thickness may be used on the interior of fireproof buildings, provided the requirements for reinforced concrete and for reinforced concrete stacks elsewhere required by this Chapter shall be complied with.

(c) Internal metal or re-inforced concrete stacks on fireproof buildings shall be surrounded by continuous air space from the lowest story through the roof not less than four inches across at any point, and said air space shall be surrounded by brick, hollow tile, or reinforced concrete. No structural metal in such air space shall be without such fireproof covering.

791. **Reinforced Concrete Chimneys—How Built.)** Reinforced concrete chimneys in which the temperature of the gases is intended to exceed 750 degrees Fahrenheit, shall be lined with fire brick or magnesia or asbestos insulating lining for the height and in the manner elsewhere required by this Chapter. If the insulating is stopped anywhere below the top of a reinforced concrete chimney or if the cross section of such a chimney is changed, then the reinforcing shall be increased at such points sufficiently to prevent the formation of temperature cracks.

792. **Tenement and Apartment House Boiler Chimneys.)** Chimneys for the heating apparatus of tenement and apartment

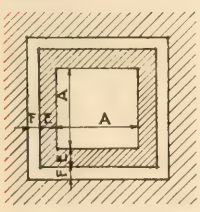


Fig. 33.

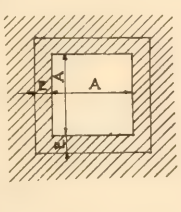


Fig. 34.

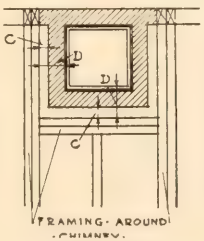


Fig. 35.

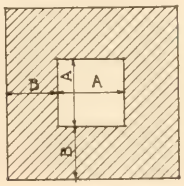


Fig. 36.

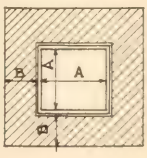


Fig. 37.

CHIMNEYS—INSULATING CAVITIES WHERE REQUIRED.
Section 794.

Figs. 33, 34 (A) Area of flue.
(E) Insulating lining.
(F) Insulating cavity.

Explanation: If A is more than 400 sq. in. an insulating lining (E) is required=(see Sec. 797 for further details). If A is more than 400 sq. in. the walls surrounding shall have an insulating cavity F not less than 3″ wide.

If E in Fig. 34 is of fire brick of 4″ or more in thickness it may be considered as a portion of thickness required for walls surrounding.

Section 797, Framing Around Chimneys.

Fig. 35. (C) Is distance joists or timbers are to be kept away from wals of chimneys = 2″.

(D) Is distance to be kept away from inside of flue lining = 7″.

Section 800. Walls Forming Smoke Flues.

Fig. 36. Shows chimney without flue lining.
If A = 144 or less, B = 8″.
If A = more than 144 and not more than 600, B = 12″.
If A = more than 600, B = 16″.
For exceptions see ordinance, Sec. 800.

Fig. 37. Shows Chimney with flue lining, not less than ¾″ thickness.
If A is 144 sq. in. or less, walls surrounding may be (B) or 4″.
If A is more than 144 sq. in. and not more than 300 sq. in. B = 9″.
If A is more than 300 and not more than 600. B = 12″.
If A is greater than 600, B = 16″ (exceptions and reductions being stated in Sec. 800).

houses shall not be considered as flues used for domestic purposes.

793. **Height of Chimneys Above Roof.)** (a) The height of all chimneys and flues of stoves used for domestic purposes or open fireplaces shall be not less than five feet higher than the highest point of the roof of the building of which they are a part.

(b) The height of all chimneys and flues above the highest portion of the roof of which they are a part, where such chimneys or flues are used for other than domestic purposes or for open fireplaces, shall be determined by dividing the greatest diameter in inches by four, and the quotient thereby obtained in terms of feet, with five feet added, shall be the minimum height from the tops of such chimneys and flues above the highest portion of roof of the building. In no case shall the height of any chimney or flue be less than five feet above the roof of the building of which it is a part.

(c) Where a wooden tank, pent house or roof house is on the same building with a chimney, the required height of any such chimney above the roof of the building shall be not less than two-thirds of the sum of the horizontal distance between the chimney and such tank, pent house or roof house added to the vertical distance between the top of such tank, pent house, or roof house and a horizontal plane through the top of the chimney. The tops of chimneys within a radius of twenty-five feet of any wood tank, pent house, or roof house, on the same building of which such chimney shall be a part shall be at least as high as the top of said wood tank, pent house, or roof house. The tops of chimneys on ridge roofs shall be not less than three feet above the ridge.

794. **Insulating Cavities — Where Required.)** All flues having a greater area than four hundred square inches shall be lined on the inside with an insulating material, which lining shall start at least two feet below the smoke inlet and shall extend upwards for at least ten times the diameter of the flue, or if said flue is not circular or square in cross section for ten times the average diameter, when the flues are of brick, stone or concrete, said insulating lining shall be fire clay brick or fire clay blocks, and if such bricks or blocks are four inches or more in thickness, they may be considered as a portion of the thickness required for the surrounding walls. The walls surrounding chimneys having an area greater than four hundred square inches shall have an insulating cavity not less than three inches wide surrounding the inner four inches of fire brick or fire clay blocks, for not less than the height required above for insulating lining and said inner core shall be built independent of the surrounding brick work and shall be free to expand or contract.

795. **Metal Chimneys in Buildings of Ordinary Slow-Burning or Mill Construction.)** Interior stacks or smoke flues of metal shall not be used in buildings of ordinary or slow burning or mill construction, unless they are surrounded by self-supporting brick or re-inforced concrete walls of the thickness herein required for flues of the respective area; provided, however, that if an interior smoke pipe of steel of not less than three-eighths inch in thickness riveted in every joint, or an interior smoke pipe of cast iron not less than five-eighths inch in thickness is used, then the brick work required inside of the insulating cavity of a stack may be omitted, but such metal linings shall be lined with such insulating material for the height herein elsewhere required for stacks. If a chimney or stack is not a part of the walls of such a building, it shall be designed as an isolated chimney as required by Section 799 of this Chapter.

796. **Insulating Material for Metal Chimneys and Metal Stacks.)** (a) Fire clay brick or fire clay blocks may be used for the insulating lining of metal chimneys and stacks but not of a lesser thickness than two inches. The material shall be increased in thickness or supported on structural steel ledges and the material shall be stressed not to exceed the safe limits of stress elsewhere herein fixed for the material, or metal chimneys and metal stacks may be lined with blocks of magnesia insulation or with fused asbestos board insulation, or metal stacks or chimneys may be lined with any other insulating material tested and approved by the Commissioner of Buildings.

(b) Magnesia block insulation shall contain not less than 45 per cent of magnesia and 50 per cent asbestos fibre formed into blocks not less than 1½ inches in thickness by hydraulic pressure. After said magnesia blocks have been set, they and all metal bands and ties exposed with the flue shall be plastered with cement not less than one-half inch in thickness on one and one-half inch blocks, and one-fourth inch in thickness on one and three-fourths inch and thicker blocks.

(c) Fused asbestos board shall be made of alternate flat and corrugated sheets of asbestos board, cemented together and fused under a heat of not less than 1,000 degrees Fahrenheit to a minimum thickness of 1¼ inches. After said fused asbestos boards have been set into the flues, they and all exposed metal bands or ties shall be pointed with cement.

(d) Such magnesia blocks, fused asbestos boards, pointing cement and any other insulating material approved by the Commissioner of Buildings shall resist the disintegrating, dissolving, or diminishing action of moist steam and the acid and gaseous fumes present in the flue at any degree of heat obtainable by the combustion of the fuel used.

797. **Chimneys — Interior — Framing Around.)** In case of chimneys which are enclosed, or form part of the interior of any building, no joists or girders shall rest or be supported on the walls of such chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

798. **Chimneys — External Location of.)** (a) Chimneys built outside of the walls of buildings shall not encroach upon any street or alley, and shall be built as follows:

(b) If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, extending to a height of at least ten feet above the street or alley grade.

(See Special Ruling XVI, Page 305.)

799. **Chimneys—Isolated—Stress Requirement.)** Isolated chimneys shall be so designed and constructed that the stress in every part thereof, due to the weight of the chimney itself and from wind pressure, shall not exceed the safe limits as provided in this Chapter for the material used.

800. **Walls Forming Smoke Flues.)** The walls forming smoke flues of one hundred and forty-four square inches area or less shall be of brick, concrete, stone, or of any one of these and burnt fire-clay flue tile lining, and such flue linings shall extend from the lowest opening to a distance of at least two feet above the roof joints. If only one of

the above materials is used it shall not be less than eight inches in thickness. Provided, however, that such flues having walls at least three inches in thickness of continuous concrete or interlocking or rabbited joint concrete sectional flues may be used without burnt fire-clay flue tile linings. If any one of the above materials is used in combination with burnt fire-clay tile flue lining it shall be not less than four inches in thickness, and the burnt fire-clay flue lining shall be not less than three-fourths inches in thickness, and built as herein described. The walls forming smoke flues of more than one hundred and forty-four square inches area and not more than three hundred square inches area shall be of brick, concrete, stone, or any one of these and burnt fire-clay flue tile lining. If any of the above materials is used alone, it shall be not less than thirteen inches in thickness. If any one is used in combination with burnt clay flue tile lining, it shall be not less than nine inches in thickness and the fire-clay flue tile lining shall be not less than three-fourths inch in thickness and built as herein required. The walls forming flues having an area greater than three hundred square inches and less than six hundred square inches shall be built of one of the materials described above not less than twelve inches in thickness, and flues having an area greater than six hundred square inches shall have walls of one of the materials described above not less than sixteen inches in thickness, and these walls may be reduced to twelve inches in thickness at a point not less than fifty feet above the top of the breeching; provided, however, that the material of which all chimneys are constructed shall be so proportioned that it will not be subjected to a greater stress than elsewhere herein fixed as the maximum safe stress for such material.

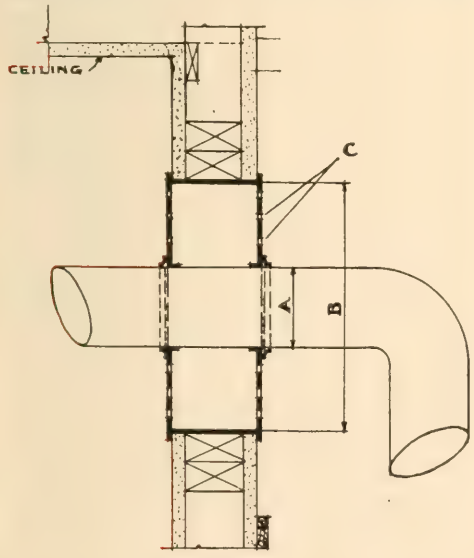


Fig. 38.

SMOKE PIPES PASSING THROUGH PARTITIONS AND WOOD WORK AROUND.

Section 802.

(A) Diameter of smoke pipe, 6″ or less.
(B) Diameter of thimble required 8″ greater than diameter of smoke pipe.
(C) Ventilation holes required.

801. **Ventilating Ducts — Chutes — Walls Forming.)** Walls forming ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls forming ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than two hundred and sixty square inches the walls shall be not less than eight inches thick.

802. **Smoke Pipes Passing Through Partitions.)** In buildings hereafter erected it shall be unlawful to allow smoke pipes of greater diameter than six inches to pass through a combustible partition. Where a smoke pipe of six inches or less passes through a combustible partition it shall be surrounded by a ventilated thimble of incombustible material or by incombustible material with a diameter at least eight inches greater than the diameter of the pipe.

803. **Boilers — Location of — Permit for.)** In all cases, boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers. The size, number and location of boilers to be installed in any building shall be marked on the plans and, except in buildings of Class III, approved by the Department for the inspection of Steam Boilers and Steam Plants, and by the Department of Health before a permit is issued by the Department of Buildings for the erection of such building.

804. **Foundry Cupolas — Construction of Charging Floors and Roofs—Height Above Roof.)** There shall be no combustible material used in the construction of a charging floor or a roof within thirty-six inches of the foundry cupola. Where the charging floor is less than eight feet above the dump floor no combustible material whatever shall be used in the construction of such charging floor. Foundry cupolas shall extend twenty-five feet above the highest point of any roof within a radius of forty feet from such cupola, unless such roof is of metal or fireproof construction.

805. **Cornices — Eaves — Gutters — Pipes from Roof.)** (a) No wood shall be used for any purpose in connection with cornices, eaves and external gutters on any building more than fifty feet in height. The entire exterior covering of cornices and eaves of buildings hereafter to be erected within the fire limits shall be of incombustible material.

(b) Wherever sheet metal cornices or eaves or external gutters are used, their entire exterior covering shall be of metal or other incombustible material approved by the Commissioner of Buildings. Bracket supports for same shall be firmly secured to the wall at least every four feet, and the walls shall be carried full height under and behind same throughout their entire length.

(c) The water from all roofs shall be carried to the sewer in metal conductor pipes. Every such conductor shall be continually maintained in good condition, and if such conductors are within the exterior walls, they shall be of screwed-joint iron or steel pipe, or of cast iron pipe with calked joints.

806. **Towers, Domes and Spires—Construction of.)** Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-quarter of the street frontage of any building. Such towers, domes, or spires, if any part thereof is built to a height of more than fifty feet and less than ninety feet, shall be of slow-burning construction, and, if of a greater height then ninety feet above the sidewalk, shall be of fireproof construction; and, in all cases where the area of such tower, dome, or spire exceeds one hundred square feet, its supports shall be carried down to the ground, and if the

structure supported is more than fifty feet and less than ninety feet high, it shall be of slow-burning construction, and, if more than ninety feet high, of fireproof construction. No tower, dome, or spire shall exceed thirty-six hundred (3,600) square feet in area, and in no case shall the area exceed fifteen per cent of the total area of the building on which it is erected, nor shall the height of any tower, dome or spire exceed four hundred feet measured from the established inside grade.

807. **Structures—Construction and Limitations of.)** All structures built within the City other than those otherwise specifically provided for herein shall be designed and constructed according to established engineering practice, and shall comply with the provisions of this section. No structure of frame or mill construction within the fire limits shall exceed 35 feet in height from the ground to the highest point thereof. No structure of mill or frame construction outside the fire limits shall exceed the height of 45 feet from the ground to the highest point thereof.

All structures over thirty-five feet in height within the fire limits, and all structures over forty-five feet in height outside the fire limits shall be built of structural steel, concrete or masonry; provided, however, that viaducts or runways to be used for the purpose of transferring livestock from one building or place to another may be built of wood not to exceed eighty feet in height either within or without the fire limits

If it is desired to enclose any structure, such structure shall be enclosed with concrete or masonry walls, or incombustible material of such construction as shall be approved by the Commissioner of Buildings; provided that structures outside the fire limits not exceeding 2,800 square feet in area, or 45 feet in height, may be enclosed with combustible material.

In every structure contemplated by this section safe and adequate means of ingress and egress shall be provided for persons employed in and about the same.

All structures whose height exceeds twice their least dimensions at their base shall be so designed as to safely resist a wind pressure of 30 pounds per square foot of surface exposed to the action of the wind.

808. **Skylights—Construction of—Glass in.)** (a) Any skylight on the roof of any building less than ninety feet in height, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood, metal clad on all exterior surfaces. Any skylight on a building more than ninety feet in height shall be entirely of incombustible material.

(b) Every skylight shall be provided with ventilation opening of an area of at least three per cent of the base area of the skylight.

(c) The glass in all such skylights, except in buildings in Classes III and VI, not exceeding three stories in height, shall have at least six inches over same a strong wire netting with wire not lighter than number twelve gauge, galvanized after weaving, and mesh not coarser than one by one inch, unless the glass contains a wire netting within itself. Supports for screen shall not be less in size than the bars supported and of the same material.

809. **Inclosures upon roof.)** Skylights, inclosures for water tanks and inclosures for elevator machinery, the construction of all of which inclosures shall be entirely of incombustible material, shall be permitted to be erected on the roofs of all buildings more than fifty feet and less than one hundred feet high; provided, however, that the roofs of same may be built of mill or slow-burning construction.

810. **Roof — Construction of — Pitch of.)** Buildings, other than frame buildings when permitted by this Chapter, less than fifty feet in height with roofs which have a slope of more than three inches per horizontal foot, shall have the roofs covered with incombustible material. Buildings more than fifty feet and less than one hundred feet in height with roofs which have a slope greater than three inches per horizontal foot and which are of timber construction, shall have such roofs covered with an incombustile covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards or other incombustible material, which shall be at least two inches thick. Where this covering is placed upon the roof boards wooden strips shall be inserted, which shall be securely fastened to the wooden structure at regular intervals between the incombustible covering and a weatherproof covering of incombustible material.

811. **Roofs—Shingle, Gravel or Composition.)** (a) The use of shingles or other forms of combustible roof covering on buildings erected or altered otherwise than is provided in Section 871, within the fire limits, is prohibited, except as hereinafter provided. In existing frame buildings not more than three stories high, the shingle roofs may be repaired with shingles or other materials.

(b) Roofs, the slope of which is not more than three inches per foot horizontal, and the covering of which is made of a composition of felt and gravel, shall be considered incombustible under the provisions of this Chapter, and may be used upon buildings of all classes. Other forms of composition roof shall be permitted if expressly approved as an incombustible roof by the Commissioner of Buildings.

812. **Buildings—Height of—Parapet Walls —Roof Houses—Housing Tanks—Skylights and Scuttles.)** (a) The limits of heights of buildings heretofore given for non-fireproof buildings shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the roof thereof. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(b) The height of a fireproof building shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(c) No building shall be erected in the City of greater height than two hundred sixty feet. The erection of parapet walls or of balustrades constructed entirely of incombustible material shall be permitted above the roof level of buildings of all classes, in addition to the height fixed herein for the same.

(d) Roof houses for elevators, tanks, skylights, stairs or scuttles may be built above the height of the main roof.

813. **Basement — Defined.)** The upper surface of the floor of the first story of buildings of every class excepting Classes VI and VIII shall be not more than ten feet three inches above the inside sidewalk grade of the street nearest the building and that portion of the building below said floor shall be designated as the basement of the building of which it is a part.

Note: See Section 634 (h).

814. **Sub-basements and Cellars — Construction of.)** (a) No building shall have more than one basement or cellar of ordinary or slow-burning or mill construction; all additional basements or cellars shall be of fireproof construction as described in this Chapter, the elevator enclosures shall

be of brick from the lowest basement floor level to the first story floor, and the stairways shall be inclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

(b) In cases where a pipe, conduit, dumbwaiter, cable, wire, conveyor or belt, or any combination thereof, passes through a floor from one basement to another, the opening in the floor shall be inclosed as specified in this Chapter.

(c) The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

815. **Concrete Floors in Basements — Requirements.)** Wherever concrete floors are laid in basements of buildings now in existence or buildings hereafter to be erected, the concrete of such floors shall be at least three (3) inches in thickness and such floors shall be laid on a sand or cinder foundation not less than six (6) inches in thickness.

816. **Canopy — Plans Must be Approved Before Permits Issue—Fee for Permit—No Advertising Matter or Obstructions Permitted.)** It shall be unlawful for any person, firm or corporation to erect or construct any canopy attached to a building or structure under any general or special ordinance now in force or which shall or may hereafter be adopted without first submitting the plans of such canopy, and also of the part of the building or other structure to which it is to be attached, to the Commissioner of Buildings for his approval. No permit shall be issued by the Department of Public Works unless the plans of such canopy shall be approved by the Department of Buildings and a permit to attach said canopy to the building from which it is intended to project shall be obtained from the Commissioner of Buildings. The owner or agent shall pay to the Department of Buildings a fee of ten dollars for said building permit. No canopy that has been or may hereafter be authorized by any general or special ordinance, which projects over any street or other public place shall at any time be enclosed by canvas or other cloth or material in whole or in part so as to obstruct free passage underneath same, nor shall any such canopy be equipped with or have attached thereto any illuminated or other signs, transparencies, placards, streamers or other advertising devices of any kind; and in case any such canopy shall at any time contain such advertising matter or device it shall be the duty of the owner, lessee or person in charge or control of such canopy, upon notice from the Mayor, to forthwith remove such advertising matter or device.

817. **Canopies and Marquees—Annual Inspection Fee.)** The Commissioner of Buildings shall make an annual inspection of canopies and marquees attached to buildings or other structures which shall extend into or over any street, alley or any public place, and for such inspection shall make the following charge:

Where the horizontal projection of the canopy or marquee does not exceed 200 square feet in area the annual inspection fee shall be five dollars; and where the horizontal projection of the canopy or marquee exceeds 200 square feet in area the fee shall be five dollars for the first 200 square feet and one dollar additional for each additional 50 square feet in the area of such canopy or marquee.

818. **Scaffolds—Protection During Building Operations—Temporary Floors.)** (a) All scaffolds erected in this city for use in the erection, repair, alteration, or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon or passing under or by the same; and to prevent the falling thereof, or the falling therefrom of any material that may be used, placed or deposited thereon.

(b) It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction of or remodeling of any building having more than three framed floors, whether some or all of such floors are above the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of the employes and all persons engaged above or below or on such temporary floor in such building.

(c) Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

(d) A good and substantial temporary floor shall be laid on the joists or girders of the next lower floor where the temporary or permanent floor of the second story or the floor or floors above the second story or roof is being placed previous to the placing of the permanent floor or floors immediately below the floor which is being arched or planked. The lowest framed floor in a building shall be considered the first floor.

(e) In buildings more than three stories high where persons are working on a scaffold or scaffolds on the outside of such building such persons shall be protected by well secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

(f) It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected, and it shall be their further duty to comply with an act of the Legislature of the State of Illinois, entitled "An act providing for the protection and safety of persons in or about the construction, repairing, alteration or removal of buildings, bridges, viaducts and other structures, and to provide for the enforcement thereof," approved June 3, 1907, and in force July 1, 1907.

(g) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building may be revoked in the discretion of the Commissioner of Buildings where such violation occurs.

819. **Wood Lathing and Plastering.)** (a) In all buildings of frame or of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with the following specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of frame or of ordi-

nary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms, not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed. Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in

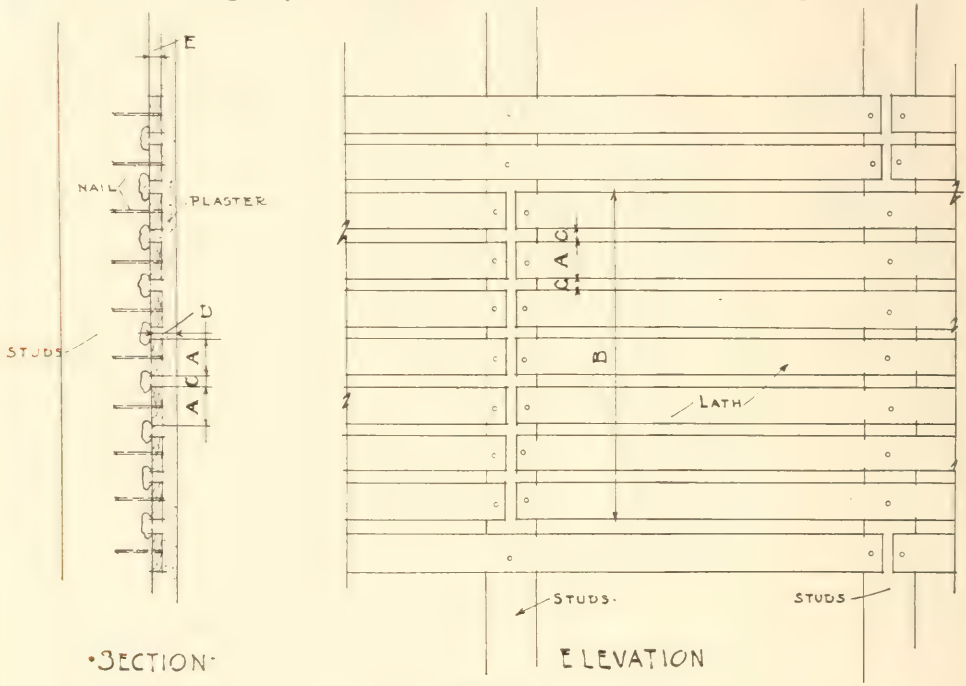


Fig. 39.

WOOD LATH AND PLASTERING.
Section 819.

(A) Lath to be 1½" wide.
(B) Break joints of lath every seventh lath.
(C) Spacing of lath not to be less than ¼" apart. (Exception Class I—⅜" spacing allowed—see Sec. 819b).
(D) Plaster coating to finish ⅞" thick. (Exception Class I—¾" thick finish—see Sec. 819b).

quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal-plates are applied on walls of buildings of frame or of ordinary construction containing one or more

the room used for the purpose of Class I; and provided further, that where such building of frame or of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-

rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this section for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

(d) Wallboard or plasterboard of gypsum, asbestos, or other approved incombustible material, containing not more than four per cent (4%) by volume of paper or other combustible fabric reinforcement may be used as a substitute for wood lath where the use of wood lath is permitted by the provisions of this chapter in buildings of frame or of ordinary construction. When such wallboard or plasterboard is attached to metal studding or metal furring and is used as a base for two coats of plaster or mortar, the wallboard or plasterboard and plastering finishing to not less than seven-eighths of an

inch in thickness in ceilings and in hollow partitions and not less than two inches in thickness in solid partitions, it may be used in this manner in such buildings and under such conditions as follows:

In buildings of slow burning and mill construction for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings.

In buildings of fireproof construction of Class II, Class III and Class VI for suspended or false ceilings below a fireproof floor system or roof system built in accordance with the provisions of this chapter and for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings. The ingredients and the proportions thereof for mortar and plaster and the manner of mixing and preparing same for plastering, as used in accordance with the requirements of this section, shall be subject to the approval of the Commissioner of Buildings.

820. **Sidewalk and Street—Occupation of —Limitations.)** (a) The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

(b) Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

(c) During the progress of building operations, a sidewalk not less than six feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

821. **Sidewalk—Delivery of Material—Elevated Sidewalks.)** It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street, and in case a sidewalk is so elevated it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

822. **Temporary Roof Over Sidewalk—Time Maintained.)** When buildings are erected of a height greater than four stories and such buildings are near the street line, there shall be built over the adjoining sidewalk a roof having a framework composed of supports and stringers of three by twelve timbers not more than four feet from center to center, covered by two layers of two-inch plank. When additional stories are added to an existing building and such building is located near the street line, there shall be built over the sidewalk, at the point where the new stories commence, a scaffold not less than six feet wide, which shall form a covering over the sidewalk composed of a framework of stringers and supports, covered by two layers of two-inch planks. Such framework and covering shall be of such construction and design as shall be satisfactory to the Commissioner of Buildings. Such roof shall be maintained as long as material is being used or handled on such street front above the level of the sidewalk. Temporary sidewalks, their railings, approaches and roofs over same, shall be made with regard to ease of approach, strength, and safety, to the satisfaction of the Commissioner of Buildings.

823. **Storage of Building Materials — Limitations.)** The occupation of the street for the storage of building material for any one building or for temporary sidewalks, shall never exceed one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any steam or street railway track, and in all cases where such obstruction of the street is made there shall be a clear space of not less than one foot between such obstruction and the curb line. Provided, that the Commissioner of Buildings and the Commissioner of Public Works, or either of them, may limit, or entirely restrict, the storage of material on any street or alley where a tunnel, conduit, or any underground passageway or subway is located.

824. **Sidewalks and Street — Excavated Material and Rubbish On—How Cared for.)** Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon the sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

825. **Use of Derricks.)** For all buildings more than four stories in height the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

826. **Frontage Adjacent — How Occupied for Building Purposes.)** If the written consent of and a waiver of claims for damages against the city by the owners of properties adjoining the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building in front of the property for which the consent of the owner or lessee thereof has been secured upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building site.

827. **Street—Use of for Building Purposes—When Terminated—Red Lights.)** (a) The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and shall terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

(b) Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

828. **Street Obstructions—Permits—Bonds —Fees.)** (a) Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid in proportion to the street frontage occupied at the rate of five dollars per month for every twenty-five feet or fractional part thereof, of frontage so occupied, and before any permit shall be granted to any person, firm or corporation for the obstruction of any street or streets or sidewalk, an estimate of the cost of restoring said street and sidewalk to a condition equally as good as before it shall have been obstructed, with a fair additional margin for contingent damages, shall be made by the Commis-

sioner of Public Works. Such estimate in no case shall be less than two dollars per foot, or fractional part thereof, frontage of the portion of the street to be obstructed, and a deposit shall be required of the person, firm or corporation desiring to obstruct said street or sidewalk. Such deposit, less the charge of five dollars per month for each twenty-five feet of frontage used, shall be returned upon the restoration of the said street and sidewalk to a condition equally as good as before it was obstructed. When the Commissioner of Public Works shall receive satisfactory proof that said street and sidewalk have been restored to a condition equally as good as before it was obstructed, he shall issue a certificate to the Comptroller, certifying to said fact, and the comptroller shall thereupon forthwith issue a warrant on the City Treasurer for the amount of money thus deposited less the deduction herein provided for. But if the person, firm or corporation thus obstructing said street or sidewalk shall fail to restore the same to a condition equally as good as before it was obstructed within three days from and after the completion of the building or structure for which said deposit was required, then the city shall have the right to use such portion of said deposit as may be necessary to remove the obstructions and to restore the said street and sidewalk to a condition equally as good as it was before it was obstructed, and the amount thus expended shall be deducted from the amount of said deposit; provided, however, that nothing herein contained shall preclude the city from maintaining any action against the person, firm or corporation to recover for damage done to any street or sidewalk. No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him, in no case to be less than ten thousand dollars, conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to, or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done or neglected to be done under or by virtue of the authority given in such permit and the requirements of the city ordinances.

(b) Any permit issued pursuant to the terms of this section may be revoked by the Commissioner of Public Works at any time.

829. **Building Operations at Night in Residential Districts Prohibited—Penalty.)** It shall be unlawful for any person, firm or corporation, in conducting any building operations between the hours of ten o'clock in the evening and four o'clock in the morning to operate or use any pile drivers, steam shovels, pneumatic hammers, derricks, steam or electric hoists or other apparatus, the use of which is attended with loud or unusual noise in any block in which more than half of the buildings on either side of the street are used exclusively for residence purposes.

Any person, firm or corporation violating any of the provisions of this section shall be fined not less than five dollars, nor more than one hundred dollars for each offense, and each day's violations of same shall be considered a separate and distinct offense.

830. **Stables and Barns — Regulations.)** (a) It shall be unlawful for any person, firm or corporation to convert any building for the use of or to construct or maintain any stable or barn for the housing or keeping of more than two horses or other animals on any lot abutting on a street or alley in which a public sewer is constructed without providing such stable or barn with an impervious floor properly drained to such sewer.

(b) It shall be unlawful for any person, firm or corporation to construct, locate, conduct or maintain any boarding, sales or private stable or barn for stabling or keeping of horses on the front two-thirds of any lot on any street where one-half of the buildings on both sides of the street between the next nearest intersecting streets are used exclusively for residence purposes without the written consent of a majority of the property owners according to frontage on both sides of the streets. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for such purpose. Provided that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

(c) It shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of four hundred feet from any school, church, hospital, public park or public playground.

(d) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense and each and every day on which such person firm or corporation shall conduct or maintain a stable or barn in violation of the provisions of this section, shall constitute a separate and distinct offense.

831. **Tannery Not to Be Placed Within 600 Feet of Any Church, Public or Private School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any building used, or to be used, for a tannery within six hundred feet of any building used for a church, hospital, public or private school, measured from the nearest point of the tannery to the nearest point of such church, hospital or school.

832. **Gas Reservoir Not to Be Placed Within 500 Feet of any Public School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any tank used or to be used for a gas reservoir within 500 feet of any public school. Said distance to be measured from the nearest point of the building or structure used for a gas reservoir to the nearest point of any building used for a public school.

ARTICLE XIV.

Fireproof Construction.

833. **Fireproof Construction — Definition of.)** The term "fireproof construction" shall apply to all buildings in which all parts that carry weights or resist strains and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator inclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction, when built as required by Section 776.

834. **Fireproof Material — Definition of.)** The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta.

835. **Fireproof Construction—Tests For—Board of Examiners.)** (a) In cases

in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this Chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have at least ten years' experience as an architect, engineer or builder, who shall take the usual oath of office. Said oath of office shall be administered by the Commissioner of Buildings. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction or material, or device for fireproofing, and furnish a copy of the same to the applicant. And such specifications shall provide that the material to be tested shall withstand successfully a fire of two hours' duration, rising to 1,700 degrees temperature, Fahrenheit, in the first thirty minutes and remaining at that temperature for the following ninety minutes. At the end of the two hours the material shall be quenched for at least five minutes with a stream of water from a one and one-eighth inch nozzle, at a nozzle pressure of fifty pounds per square inch. The said examiners shall notify such applicant to submit the proposed material for such examination and test; and such tests shall be made in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners and such examinations and tests, shall be paid by the applicant, and said examiners may require security therefore.

(b) The said examiners shall within 30 days after such examination and tests, certify the results of such test, and their decision on the said application to the Commissioner of Buildings, who shall in the event of the examination and tests being satisfactory, authorize the use of such material or construction as fireproof material.

(c) A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

(d) The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this Chapter.

836. **Incombustible Material.)** The following materials shall be considered as incombustible material: A metal or fire-resisting glass not less than one-quarter of an inch in thickness, metal, plastering on metal lath and metal-studding, plaster blocks, stone, granite, marble, approved cinder concrete, or one of the fireproof materials described in this chapter.

837. **Walls — Enclosing in Buildings of Steel Skeleton Construction.)** If buildings are made of fireproof construction, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall not be less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

838. **Columns—Exterior protection.)** (a) All iron or steel used as vertical supporting member of the external construction of any building exceeding fifty feet in height shall be protected against the effects of external change of temperature, and of fire by a covering of fireproof material consisting of at least four inches of brick, hollow terra cotta concrete, burnt clay tiles, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The distance of the extreme projection of the metal, where such metal projects beyond the face of the column, shall be not less than two inches from the face of the fireproofing; provided, that the inner side of exterior columns shall be fireproofed as hereafter required for interior columns.

(b) Where stone or other incombustible material not of the type defined in this ordinance as fireproof material is used for the exterior facing of a building, the distance between the back of the facing and extreme projection of the metal of the column proper shall be at least two inches, and the intervening space shall be filled with one of the fireproof materials.

(c) In all cases, the brick, burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

(Exterior and Interior Illustrations on the next page.)

839. **Columns — Interior.)** (a) Covering of interior columns shall consist of one or more of the fireproof materials herein described.

(b) If such covering is of brick it shall be not less than four inches thick; if of concrete, not less than three inches thick; if of burnt clay tile, such covering shall be in two consecutive layers, each not less than two inches thick, each having one air space of not less than one-half inch, and in no such burnt clay tile shall the burnt clay be less than five-eighths of an inch thick; or if of porous clay solid tiles, it shall consist of at least two consecutive layers, each not less than two inches thick; or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, provided that if concrete is used for such layer it shall not be less than two inches thick.

(c) In the case of columns having an "H" shaped cross section or of columns having any other cross section with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to two and one-half inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the columns, shall be filled solid with fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

840. **Columns — Wiring Clay Tile On.)** (a) Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around tile in such manner that every tile is crossed at least once by a wire. If iron or steel wire is used it shall be galvanized and no wire used shall be less than number twelve gauge.

(b) In places where there is trucking or wheeling, or handling of packages of any

kind, the lower five feet of every column incased with hollow tile shall be incased in a protective covering of No. 16 U. S. gauge steel embedded in concrete.

841. **Concrete—Approved Cement—When Fireproof.)** (a) All approved cement concrete shall consist of a standard Portland cement, torpedo sand, and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of all materials except the Portland cement shall not exceed eight times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

(b) Cement concrete to be considered a fireproof material shall comply with the provisions of Section 776 and shall be cast and worked in an unset condition against the metal. In all cases where cinder concrete is used, the metal shall be protected as required by Section 780 of this Chapter.

Fig. 40.

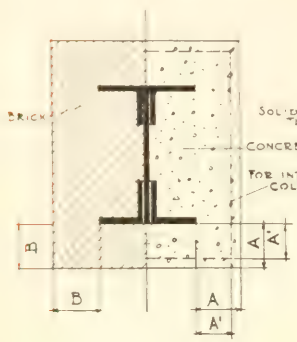


Fig. 41.

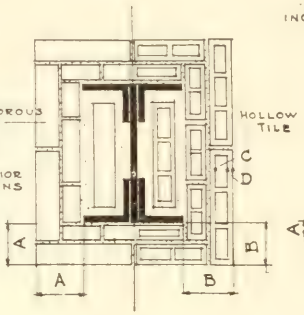
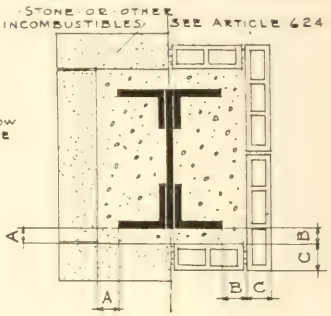


Fig. 42.



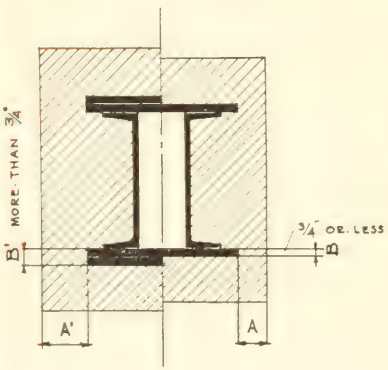


Fig. 43.

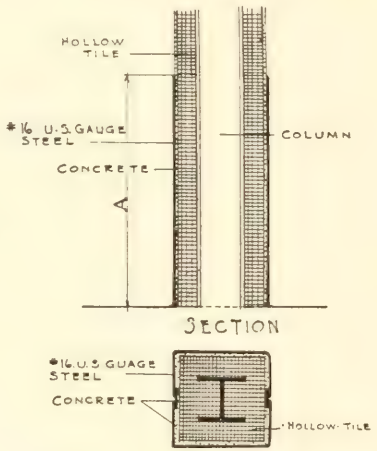


Fig. 44.

PROTECTION OF EXTERIOR COLUMNS.

Section 838.

Figs. 40, 41, 42. Requirement for protection of columns of building exceeding 50 ft. height from external change of temperature and fire.

Fig. 40. (A) 4″ concrete required.
(B) 4″ brick required.

Fig. 41. (A) 4″ solid porous tile required.
(B) 4″ hollow tile required.

Fig. 42. (A) If stone or other incombustible material is used for exterior facing then (A) can equal 2″.

(B) (C) Combination of materials in fire-proofing, etc., is allowed as at (B plus C), providing their combined thickness is not less than 4 inches.

PROTECTION OF INTERIOR COLUMNS.

Section 839.—Requirements for Interior Columns.

Fig. 40. (A′) Concrete 3″ (shown dotted).
(B) Brick 4″.

Fig. 41. (A) Solid porous tile, two layers of 2″ each tile.
(B) Hollow tile, 2 layers of 2″ each.
Fig. 41. Hollow tile (C) is to equal 1½″ air space, and (D) not less than ⅝″.

Fig. 42. (B plus C). Each equal ½ thickness required, if used singly, provided if concrete (B) is used it shall not be less than 2″.

Section 839c.

Fig. 43. In case of H shaped cross section of columns, etc., fire-proof covering may be reduced to 2½″ (A) providing (B) flange projection is ¾″ or less.

If (B) is more than ¾″ as at (B′) then A must be as before specified for interior columns as at (A′).

Section 840b.

Fig. 44. Drawing showing protective casing for lower part columns, (A) = 5′ 0″.

842. **Concrete Ingredients.)** (a) The separate ingredients of concrete shall be measured for each batch, and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing. The concrete shall be worked continuously with suitable tools, as it is put in place, filling the forms completely.

(b) The sand to be used for concrete shall be clean coarse sand, free from loam or dirt. If crushed stone grit is used it shall be clean, gritty, and free from dust.

(c) The stone to be used in concrete shall be clean crushed hard stone, or clean crushed blast furnace slag, or gravel, and of a size to pass through a 1½-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using.

(d) In all cases, the brick or hollow tile, solid tile, or terra cotta shall be bedded in cement mortar close up to the iron or steel

scribed for fireproof partitions in this chapter, and no wood shall be used in the construction, support or fittings of such shaft The area of space thus enclosed shall not exceed the area of the floor opening by more than one hundred per cent.

(b) All burnt clay or terra cotta partitions or walls around such shafts shall be plastered on the outside and plastered or pointed on the inside.

(c) All doors, frames, sashes, casings and windows in partitions or walls around such floor openings, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material. In the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be wired glass.

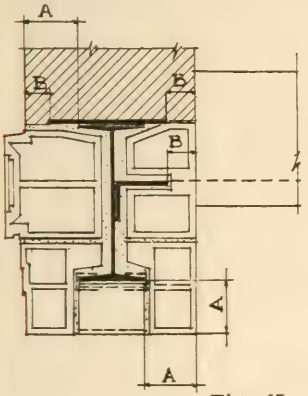


Fig. 45.

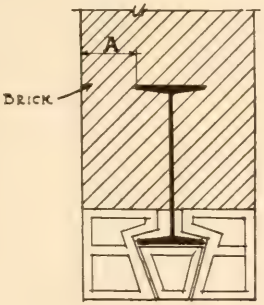


Fig. 46.

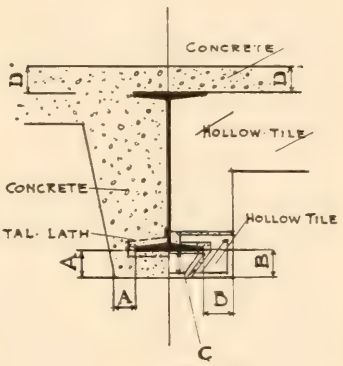


Fig. 47.

PROTECTION OF BEAMS.
Section 845, 846.

(A) Fire-proof covering for beams, girders, etc., for exterior structural parts, Sec. 845. See provisions for columns (Sec. 838) for A.

Fig. 45. (B) Allowable covering for shelf angles, etc., not figured part of flange section to be 2″.

Figs. 45, 46, 47. Necessary fire-proof covering for beams, girders, etc., for interior structural parts (Sec. 618).

Fig 46. (A) 4″ for brick (Sec. 846b).

Fig. 47. (B) 2″ for hollow tile or solid tile (Sec. 618b).

(A) 2″ for concrete (Sec. 846b).

(C) ¾″ air space by width of metal surface to be covered as required (Sec. 846b).

(D) Concrete covering for tops of beams, girders, etc., to be 2″ (Sec. 846c).

member and all joints shall be made full and solid.

843. **Pipes Enclosed by Covering.)** (a) Pipes shall not be enclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building; provided, however, gas or electric light conduits not exceeding one inch diameter may be inserted in the outer three-fourths inch of the fireproofing of such structural member, where such fireproofing is entirely composed of concrete.

(b) Pipes or conduits may rest upon the tops of the steel floor beams or girders, provided they are imbedded in cinder concrete to which slaked lime equal to five per cent of the volume of concrete has been added before mixing or their being imbedded in stone concrete.

844. **Shafts—Doors—Frames—Enclosure.)** (a) In cases where a pipe, conduit, dumb waiter, cable wire, conveyor, belt, or any combination thereof, passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening in each story above and below such hatch or floor opening in the same manner as de-

(d) Such fireproof enclosures may be omitted if all of the space in each floor opening not occupied by pipes, conduits, cables, wires, or any combination thereof, are filled in solid fireproof material not less than eight inches thick.

845. **Spandrel Beams, Girders, Lintel.)** The metal of the exterior side of the spandrel beams or spandrel girders of exterior walls, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material as specified for the exterior columns in this chapter; provided, however, that shelf angles connected to girders by brackets or projections of girder flanges not figured as part of the flange section, may come within two inches of the face of the brick or other covering of such spandrel beams, girders or lintels. The covering thickness shall be measured from the extreme projection of the metal in every case.

(Illustrations of beams on next page.)

846. **Beams, Girders and Trusses—Coverings of.)** (a) The metal beams, girders and trusses of the interior structural parts of a building shall be covered by one of the fireproof materials hereinbefore specified so applied as to be supported entirely by the

beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting.

(b) If the covering is of brick, it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, such tiles shall be not less than two inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

(c) The top of all beams, girders, and trusses, shall be protected with not less than two inches of concrete or one inch of burnt clay bedded solid on the metal in cement mortar.

(d) In all cases of beams, girders or trusses, in roofs or floors, the protection of the bottom flanges of the beams and girders

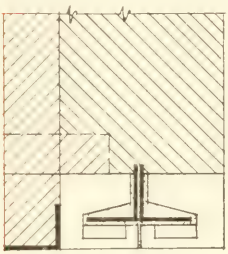


Fig. 48.

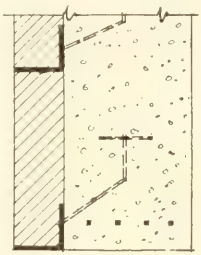


Fig. 49.

Where lintels are fireproofed previously and independently, the Commissioner of Buildings has ruled that the application of the architectural facing may be supported as shown (Fig. 48, 49).

and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials, excepting the air spaces in hollow tile.

(e) Provided, however, that all girders or trusses when supporting loads from more than one story shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials as required for interior columns in Section 839 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

(f) The fireproofing herein required for metal structural roof members may be omitted in buildings used exclusively for purposes of Class IV and of Class V, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the structural roof members. There shall be no openings in ceilings other than those required for ventilation. Where the plane of the ceiling is twenty feet or more above the floor of the open space, all structural members or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter. The fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is nearer than twenty feet to the floor of the open space all structural members above or below such ceiling to the height of twenty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceilings for ventilation shall be connected by a conduit or duct to the outside of the building. Ducts shall be of metal or other incombustible material and if of metal where such ducts have an area greater than 400 square inches same shall be constructed double with an intervening air space.

847. **Fireproofing of Exterior Sides of Mullions.)** In buildings required by this chapter to be of fireproof construction or exposures where metal frames, doors, sash and wired glass are not required, all vertical door or window mullions over eight inches wide shall be faced with incombustible material, and horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

848. **Fireproof Covering, Independent.)** The fireproof covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previous to and independent of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

849. **Walls, Support and Fireproofing of.)** Where skeleton construction is used for the whole or part of a building the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

850. **Iron or Steel Plates for Support of Wall.)** Where iron or steel plates or angles are used in each story for the support of the facings of the walls of such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fibre stress for iron and steel elsewhere specified in this chapter of the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

851. **Cut-out Boxes, Chases, Etc.—Fireproof Covering.)** No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or if any other recess is to be concealed, or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

852. **Segmental and Flat Arches.)** (a) Segmental arches shall have a rise of at least one inch for each foot of span of arch.

(b) The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

(c) Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skewback of the arches shall be carefully fitted to the beams supporting them, and, in addition to the cross ribs, there shall be additional diagonal re-enforcing ribs in the skewback. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

(d) Burnt clay skewbacks shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

853. **Fireproof Floor and Roof Construction.)** Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved

cinder concrete, shall be used for the construction of floor and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inches for each foot of span.

854. **Wood Flooring and Nailing Strips.)** (a) Wood flooring and wooden nailing strips for such flooring may be used in fireproof buildings.

(b) Where such flooring is used in a fireproof building, the space immediately under the flooring, and between the nailing strips and under such nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or with such other incombustible material as shall be approved by the Commissioner of Buildings.

855. **Partitions in Fireproof Buildings.)** (a) Where stairs, shafts and elevators are enclosed they shall be enclosed in fireproof partitions, as described in Section 856 of this chapter; all other partitions, shall be incombustible partitions. Where blocks are used for building partitions, the joints shall be well filled with mortar.

(b) The partitions shall be wedged tight between floor and ceilings with incombustible wedges.

856. **Partitions — Fireproof — Incombustible.)** (a) Only fireproof material shall be used for fire proof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than three inches thick.

(b) All fireproof partitions required by this ordinance shall be supported directly on the steel construction, or on the fireproof floor arches, or on concrete, or on brick.

(c) Only fireproof or incombustible material shall be used in the construction of partitions not required to be fireproof, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

(d) All corridor partitions of incombustible or fireproof material in fireproof buildings, shall be supported directly on the steel construction, on the fireproof floor arches, on concrete or on brick.

857. **Stairs—Landings.)** (a) Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or metal, or a combination of one or more of such materials.

(b) The handrails of such stairways may be of wood.

(c) If stairs are constructed of solid stone or plain concrete, having the tread and riser in one piece, then there shall be not less than sixty square inches of stone or concrete in the cross section of such combined tread and riser.

(d) If stone treads have less than sixty inches of cross section and platforms less than seven inches in thickness are used, they shall have a metal sub-tread and sub-platform three thirty-seconds of an inch thick.

(e) If platforms have a floor arch subconstruction as described in Section 852 and 853 of this chapter, then the metal subplatform may be omitted.

858. **Roofs—Rise of Roof Above Limit of Height.)** In the case of buildings which are fireproof in their construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of the wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an inclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

859. **Sheet Metal Work—Support Of.)** Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than fifty feet in height.

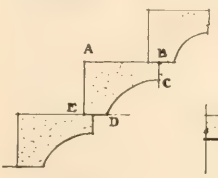


Fig. 50.

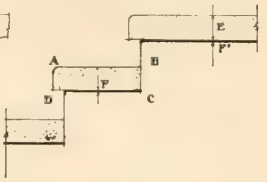


Fig. 51.

Section 854c.

Fig. 50. Area of cross section A B C D E shall not be less than 60 sq. inches.

Section 854d.

Fig. 51. If area of cross section (A B C D) is less than 60 sq. inches or (E) (thickness of platform) less than 7 in., then metal sub-tread F and sub-platform F' (= 3/32 in. thickness) is required.

Section 854e gives exception to above.

ARTICLE XV.

Slow Burning Construction.

860. **Slow-Burning Construction Defined.)** The term "Slow-Burning Construction" shall apply to all buildings in which the structural members, other than walls elsewhere required to be of masonry, which carry the loads and strains which come upon the floor and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted where such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. The lower five feet of metal columns shall be protected as required in Section 848 of this Chapter. Underside of joists shall be protected by a covering of three coats of plaster laid on metal lath; and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of same.

The fireproofing herein required for metal structural roof members may be omitted in any building of slow-burning construction used exclusively for purposes of Class IV of seating capacity less than one thousand persons or in any building of slow-burning construction used for purposes of Class IV in combination with any other Class where such part of such building as is used for purposes of Class IV has a seating capacity of less than one thousand persons and is separated from all other parts of such building by brick walls of thickness required in this Chapter and also by floors of fireproof construction, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the structural roof members. There shall be no openings in ceiling other than those required for ventilation. Where the plane of the ceiling is thirty feet or more above the floor of the open space all structural members or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter, the fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is

nearer than thirty feet to the floor of the open space all structural members above or below such ceiling to the height of thirty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceiling for ventilation shall be connected by a conduit or duct to the outside of the buildings. Ducts shall be of metal or other incombustible material, and if of metal where such ducts have an area greater than 400 square inches same shall be constructed double with an intervening air space. The floor levels of balconies and galleries having a gross area of less than fifteen per cent (15%) of the gross area of the floor of such open space shall not be used as a basis for calculating the height of such fireproofing.

861. **Posts, Girders and Partitions.)** Wood posts, if used, shall be of not less than one hundred square inches sectional area. Wood girders, if used, shall be of not less than seventy-two square inches sectional area. All partitions in buildings of this type shall be made entirely of incombustible material. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

862. **Stair, Construction of.)** Where buildings are required to be of "slow burning" construction, all stairs in such building shall be of incombustible material, except as hereinafter provided. Said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XVI.

Mill Construction.

863. **Definition — Mill Construction Requirements.)** The term "Mill Construction" shall apply to all buildings in which wooden posts, if used, have a sectional area of not less than one hundred square inches, and wooden girders and joists a sectional area of not less than seventy-two square inches, and roofs, if of wood, a thickness of not less than two and five-eighths inches in a single layer, except where the building is equipped throughout with a sprinkler system, subject to the approval of the Chief Fire Prevention Engineer, in which event such layer may be not less than one and five-eighths inches thick, and floors, if of wood, a thickness of not less than three and one-half inches in not more than two layers, the lower one of which shall be not less than two and five-eighths inches in thickness, and in which all structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted in case such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. All floors and roofs not constructed as above shall be of fireproof construction as elsewhere required for fireproof construction in this chapter.

864. **Fireproofing.)** (a) Partitions in buildings of mill construction shall be made entirely of incombustible material. If iron columns, girders, or beams are used in buildings of this type they shall be protected as specified in this Chapter; but the wooden posts, girders and joists need not be protected by fireproof covering. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

(b) If reinforced cinder concrete construction is used in the structural parts of a building which is required to be of slow-burning or mill construction by this chapter, then all partitions shall be of incombustible material and all parts other than structural parts and partitions of the building shall be as required for slow-burning or mill construction buildings by this chapter.

865. **Stair Construction Where Automatic Sprinkler System is Installed.)** In buildings required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material, except as hereinafter provided. Said stairs may be of wood construction if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

ARTICLE XVII.

Ordinary Construction.

866. **Ordinary Construction Defined.)** The term "ordinary construction" as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings and in which the walls are of masonry built as required by this chapter.

ARTICLE XVIII

Frame Buildings.

867. **Repairing of Frame Buildings Within Fire Limits.)** Frame buildings within the fire limits which have been damaged by fire, decay or otherwise, to an extent not greater than fifty per cent of their value may be repaired, provided there is no increase in size of such buildings over their original dimensions, and, provided that incombustible roof covering required by Section 811 is used. And, provided, further, that where any frame building is raised for the purpose of erecting a basement story under the same, the walls enclosing such basement shall be of masonry.

868. **Frame Buildings Prohibited—Exceptions.)** (a) Hereafter no frame building shall be erected, nor any frame addition made to an existing frame building within the fire limts of the city, except where express provision is made in this chapter therefor.

(b) Outside the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet. Provided, however, that in no case shall any portion of any frame building above the second floor be used as a separate living apartment.

(c) It shall be lawful to surround frame buildings with a veneer of brick not less than four inches in thickness, provided the said brick is not carried higher than the second story, or twenty-two feet above the basement ceiling; and provided further that the said veneer is anchored to the studding or other frame construction in a manner satisfactory to the Commissioner of Buildings. Such brick veneer is not to be placed on gables or any other parts of frame buildings above the height herein specified. All frame buildings which it is desired to surround with brick veneer must have their basement walls and foundations of solid masonry, as provided in Section 872.

869. **Frame Buildings Within the Fire Limits Changed Into Flat Buildings—Fire Walls.)** Whenever any frame building within the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

870. **Frame Buildings—Raising—Requirements—Changing Gable or Hip Roofs to Flat Roofs.)** Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of

height hereinbefore fixed for new frame buildings, and no more, and inside the fire limits for the purpose of putting a masonry basement thereunder. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roof, and in no case shall a two-story and attic building be converted into a three-story building thereby.

871. **Frame Buildings Carried to a Uniform Height.)** Where the different parts of a frame building inside the fire limits are of different heights a one-story portion may be raised to the height of two stories, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings and provided, that no room in the existing building or in the addition thereto shall violate the requirements of this chapter for habitable rooms.

872. **Basement or Story Placed Beneath Frame Buildings.)** A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than 16 feet above the grade of the sidewalk upon which such premises abut. Where a building so raised is one story in height only and the same is raised so as to permit a basement under the same not to exceed six feet six inches in height from the basement floor to the ceiling of said basement, the said house may be placed upon cedar posts. In all other cases the walls enclosing such basement or story shall be of masonry and not less than 12 inches thick except where a one-story frame building is raised and has a basement only built thereunder, the masonry walls of such basement may be eight inches thick above grade and 12 inches thick below. The foundation of such wall shall be constructed as provided in this chapter; provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thickness of walls hereinbefore required shall also apply to brick walls in new frame buildings.

873. **Chimneys in Frame Buildings—Chimney Flues Through Partitions.)** Chimneys in frame buildings shall be built as required by Section 800 of this chapter. The wood framing of frame buildings shall be trimmed around chimneys in such a manner as not to come within two inches of same.

874. **Lot Lines—Requirements as to—Number — Dimensions.)** Frame buildings, excepting sheds not exceeding three hundred square feet in area and not exceeding fourteen ft. in height from the ground, shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted, except as hereinafter provided. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness of not less than four inches and of construction to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, unincloased by such fire walls, and if openings are inserted in such fire walls, then such walls shall be built of brick not less than eight inches thick, and such openings shall have doors as described in Section 789. Each section of such buildings shall be regarded as a separate building for the purpose of determining the number and construction of its stairways and means of egress. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them except where both buildings are used for living purposes, and in that case the distance shall be governed by Sections 641 and 642 of this chapter.

Note: See also Sec. 488 (b) as to distance between lot and building lines (Class III).

875. **Sheds—Open Shelter—Height of Walls and Foundations—Enclosed.)** (a) Except as hereinafter provided, open shelter sheds not exceeding eight hundred square feet in area may be erected within the fire limits, provided they have roofing of incombustible material and the highest point is not over fifteen feet above the ground, and provided that the roofs be supported on sufficient posts or piers; provided further, however, that such sheds may be built with an area not to exceed sixteen hundred square feet, if they are kept at least twenty-five feet from any lot line and any other building or structure. Such sheds shall have no combustible enclosing walls or wooden floors, except that a floor of two-inch planking laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

(b) If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

(c) Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings; provided, however, that shelter sheds which comply in other respects with the requirements of this section, may be built not to exceed nine thousand square feet in area where such sheds are located at least twenty feet distant from any other structure and from any lot line.

(d) It shall be lawful to erect inclosed wooden shelter sheds at any fire department station in the city for the storage of fuel and supply wagons. Such sheds shall not exceed twenty-five feet in width, thirty feet in length and fourteen feet in height.

(e) Sheds not exceeding fourteen feet in height from the ground to the highest point thereof, and not exceeding three hundred square feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

(f) Frame auto-sheds housing not to exceed two automobiles or auto cars may be erected inside the fire limits of area not to exceed 400 square feet. Such auto-sheds shall have an incombustible roof and shall have a concrete floor not less than 4 inches thick laid directly upon the ground. At the time of applying for a permit for such auto-shed, applicant shall submit a plat of the lot showing the location of same made by a licensed surveyor and giving the established grade of the alley upon which such auto-shed shall open. Such shed shall not exceed 14 feet in height and shall be situated on the rear of

the lot; shall be used for the purpose of housing automobiles only and there shall not be more than one such shed on any lot or premises.

876. **Sheds—Coal, Brick, Stone, Cement and Salt Sheds and Sheds for Icing Cars Along Railroad Tracks and Navigable Stream Frontage Consents.)** Open shelter sheds to be used for the storage or handling of coal, brick, stone, cement, salt or such commodities which are incombustible, or for the icing of cars, may be erected within or without the fire limits upon, along or adjacent to steam railroad tracks, or along or adjacent to navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed 35 feet in height from the ground to the highest point of the roof; provided, further, that said sheds shall be located at least 25 feet distant from any other structure and from any side lot line. If it is desired or intended to enclose any such sheds, the enclosing walls shall be of incombustible material. No such shed shall be built upon any lot or parcel of ground fronting upon any street within 200 feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person, firm or corporation desiring to erect and maintain such shed, and said written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for such shed.

877. **Ice Houses.)** (a) Houses within the fire limits to be used exclusively for the storage of ice, not exceeding forty-five feet in height, and of a floor area not exceeding 9,000 square feet, may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; eight-inch walls of brick or tile or approved cement concrete with proper foundations of masonry shall be used for such envelopes.

(b) Houses to be used exclusively for the storage of ice, located outside of the fire limits and contiguous to any lake and six hundred feet from any other building, except buildings used in connection with the conduct of said business, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed eighty thousand square feet, unless the building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof; and shall extend at each end not less than one foot beyond the enclosure of said building and such wall shall be subject to the approval of the Commissioner of Buildings.

(c) Houses to be used exclusively for the storage of ice, located outside of the fire limits, and contiguous to railroad tracks and not within one hundred feet of any other building, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed 20,000 square feet unless the building is divided by a solid wall of masonry for each additional 20,000 square feet of floor area or fractional part thereof; said wall shall extend at least one foot beyond the enclosure of said building on each end and shall be approved by the Department of Buildings.

(d) All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than twelve inches at any point thereof.

ARTICLE XIX.

Stairways.

878. **Stairways, Number—Location—Construction.)** (a) Fireproof office buildings existing at the time of the passage of this ordinance which are equipped either with one stairway and two or more stairway fire escapes or with two stairways and one or more stairway fire escapes, shall not be required to have additional stairways or stairway fire escapes.

(b) Except as otherwise expressly provided in this Article, it shall be unlawful to construct or maintain any building or structure of Classes I, II and VII unless its stairway or stairways comply with the following provisions:

(c) In every existing building of ordinary construction having an area greater than 9,000 square feet or of mill or slow-burning construction greater than 12,000 square feet, there shall be not less than three stairways. The width of stairs shall be at least eighty per cent of the width of stairs as computed by the formulæ given herein and in no case less than twelve feet.

(d) Every building shall have at least one stairway from the ground to the top floor and one stairway from the lowest basement or cellar to the street grade, and no stairway shall be less than three feet in width.

(e) The width of stairs required for a building shall be construed as the total width of all stairways required on the building. Stairs shall be measured between the wall and handrail for a single stair and between handrails where two or more handrails are required by this chapter.

The aggregate width of door openings at, or approximately at the street level in buildings of all classes shall be equal to the aggregate width of stairways as specified in this article. The use of revolving doors shall not be permitted in any building of Class IIc or of Classes III, IV, V, VIII or IX.

(f) In buildings of Class I and Class IIa the width of stairs and fire escapes required for a building shall be determined by the floor area measured on the third floor of the building and such area shall not include walls, columns, stairs, elevator shafts, well holes, chimneys and corridors. In all cases where the building is less than three stories in height the width of stairs shall be determined by the floor area of the second floor as hereinafter specified.

(g) Where the enclosed space between a ceiling and the roof of a building of any Class is of greater average height than two feet in the clear, access shall be provided by means of at least one stairway not less than three feet wide leading from a public hallway or corridor.

(See Illustration, Sec. 613).

879. **Stairs—Number and Width of in Classes I, II and VII.)** (a) In buildings of Class IIb, Class IIc and Class VII the number and width of the stairs and fire escapes shall be determined by the area of that portion of the third floor not occupied by walls, columns, stairs, elevator shafts and well-holes.

In buildings of Class I, II and VII the number and width of stairs required shall be as follows:

(b) In Ordinary Construction.

With floor area of 5,000 square feet or less, two stairways;

With floor area of 5,000 to 9,000 square feet, three stairways.

Provided, however, that in buildings of ordinary construction, existing prior to December 5, 1910, with floor area of 5,000 square feet or less, one stairway only shall be required where the building is also equipped with an outside stairway fire escape, and in all such buildings with floor area of from 5,000 to 9,000 square feet, two stairways only shall be required; in case such building is also equipped with an outside stairway fire escape. Where such buildings are equipped with ladder fire escapes, erected

in compliance with the ordinance now in force, one-half the width of such ladder fire escape shall be credited in computing the width of stairs required therein.

(c) The width of stairs required in buildings of ordinary construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by twelve and dividing the product by 1,000 and adding 72 inches to the quotient, expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3000) \text{ times } 12}{1{,}000}$$

(d) In Mill or Slow-Burning Construction.

With floor area of 6,000 square feet or less, two stairways.

With floor area of 6,000 to 12,000 square feet, three stairways.

(e) The width of stairs required in buildings of mill or slow-burning construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by eight and dividing the product by 1,000 and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 8}{1{,}000}$$

(f) In Fireproof Construction.

With floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

With floor area of 21,000 square feet and over, five stairways.

(g) Provided, however, that in fireproof buildings having an area of 21,000 square feet or more only four stairways shall be required if such building is completely equipped with an approved automatic sprinkler system.

(h) The width of stairs required in buildings of fireproof construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by six and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 6}{1{,}000}$$

(i) Provided, however, that where buildings of Class I are of fireproof construction and are used solely for storage warehouse purposes and the number of persons employed on any one floor does not exceed the number specified hereafter in this section they shall comply as to number of stairways as follows:

With floor area less than 8,000 square feet where not more than ten persons are employed on a floor, two stairways.

With floor area greater than 8,000 square feet and less than 15,000 square feet where not more than fifteen persons are employed on a floor, three stairways.

With floor area greater than 15,000 square feet where not more than twenty persons are employed on a floor, four stairways.

(j) The width of stairs shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by four and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 4}{1000}$$

(k) Provided, however, where buildings of Class I are used solely for storage or warehouse purposes and the number of persons regularly employed above the floor nearest the street level does not exceed ten persons or where the number of persons occasionally employed above the floor nearest the street level does not exceed twenty persons, the floor area of such building may be increased fifty per cent (50%) in excess of the area limits as provided in this Section for buildings of Class I of ordinary, slow-burning mill or fireproof construction for the given number of stairways. The width of such stairways shall be as determined by use of formula given for each separate type of construction, by using two-thirds of the actual floor area of such building as a basis for the calculation, and by substituting the words and figures, "54 inches," for the words and figures, "72 inches," where they occur in said formula. There shall be not less than two stairways, or one stairway and a stairway fire escape directly accessible from each area of such building, and the location of all stairways and fire escapes shall be subject to the approval of the Commissioner of Buildings. The minimum width of any stairway in such buildings now in existence shall be not less than thirty inches (30″), the minimum width of any stairway in such buildings hereafter erected or hereafter converted to such use shall be not less than thirty-six inches (36″), and the minimum width of any fire escapes shall be not less than twenty-four inches (24″).

880. **Stairs — Handrails — Other Requirements.)** (a) The width of stairway fire escapes and three-quarters of the width of sliding fire escapes required by this chapter may be deducted from the width of stairs required.

(b) Stairways shall be located as far from each other as practicable. The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story and the line of travel from stairway to stairway shall be direct and easily accessible each to the other. At least one stairway shall extend to the roof of every building. In Classes I, II and VII, the whole number of stairways required for each building shall be complete in every respect from the first to the topmost story.

(c) Every story below the street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where a basement or cellar is used for the retail sale of goods the stairway from such basement or cellar shall in number and aggregate width comply with the requirement of this section for the first four stories above sidewalk grade.

(d) Where two areas of the same building adjoin and are separated by fireproof dividing walls they may have a stairway in common, provided such stairway is not less than five feet wide and is inclosed in all stories of the building by fireproof walls in non-fireproof buildings and by fireproof partitions in fireproof buildings; and where the stairways and landings are built as required by this chapter for buildings of fireproof construction, and where the doors, frames, sashes and casings, and the glazed portion thereof are built as described in Section 784 and 789 then in such case such stairway may be considered as equivalent to one open stairway from each such area, and where such stairway provides exit from only one floor area such stairway may be

considered as equivalent to two open stairways but in no case shall there be less than two stairways in any such building except as otherwise provided in this chapter.

(e) Where adjoining buildings or buildings on opposite sides of an alley or other open space, and of the same class, used by the same person, firm or corporation, are connected by fireproof bridges or passageways with fireproof doors at each end, or by fireproof doors on each floor built and equipped as required by this chapter for dividing wall doors if such bridge or passageway or fireproof door is located as far as practicable from the stairways in both said buildings, then said bridge or passageway or fireproof door may be considered to be equivalent to a stairway for each of the two areas.

(f) In buildings of Classes I, II and VII, where an interior stairway is enclosed in a tower and built as required by the provisions of Section 881 paragraph (n) of this Chapter, then such stairway shall be considered the equivalent of two stairways, or a stairway and a fire escape; provided, however, that if such stairway is considered the equivalent of two stairways the building must be equipped with a stairway fire escape, or fire escapes, as is required by this Chapter.

(g) Exterior stairways in buildings of Class I, II and VII built entirely of steel and iron, having ice-proof treads not less than ten inches wide from nosing to riser and a rise of eight inches or less for each riser, and otherwise made as required for stairway fire escapes in this chapter and where such stairway fire escape extends from the inside grade to the top floor of the building or is supplied from the second floor to the ground with a counterbalanced section and has a steel ladder from the top landing to the roof, then such stairway may be considered the equivalent of one interior stairway and one stairway fire escape if the width of such stairway and that of the one or more stairways in the building equals the width of stairs required by this chapter; provided, that in such case the respective floors, door sills, and stairway platforms are flush, and that the doors do not obstruct the stairs or platforms and that the doors are each at least 90 per cent of the width of said stairway and that the windows, doors and frames passed by such stairway and platforms are built of incombustible material and wired glass.

(h) In buildings of Class I not more than three stories in height, a stairway fire escape not less than three feet wide located and built as required by this chapter for such fire escape and placed as far as practicable from the stairway, may be considered as a stairway and may be deducted from the "width of stairs" required for the building.

(i) The width of different stairways need not be alike, and for each four stories or fractional number of stories of the building above the first four stories each stairway may be reduced six inches, but no stair in a Class VII building shall be less than three feet in width.

(j) Stairways which are less than three feet three inches wide shall have not less than one hand rail and stairways which are more than three feet three inches wide shall have not less than two handrails. Stairways which are over eight feet wide shall have double intermediate handrails with end newel posts at least five and one-half feet high at all stair landings.

(k) Stairways hereafter erected shall not be spiral stairways or have any winders. Provided, however, that circular or elliptical stairways may be used if the width of treads one foot from the center of the handrail next to the well-hole is nine and one-half inches, including nosings.

(l) Stairways shall not have risers more than eight inches high nor treads less than ten inches wide, inclusive of nosings.

(m) The bottom of any counter-balance stairway or ladder fire escape hereafter erected on any public thoroughfare when raised shall be not less than fourteen feet above the pavement or surface of the street or alley.

(n) The location of every stairway required by this article shall be subject to the approval of the Commissioner of Buildings.

(See Illustration, Sec. 613).

ARTICLE XX.

Fire Escapes.

881. **Fire Escapes — Number and Location.)** (a) It shall be unlawful for any person, firm or corporation to construct or maintain any building of Classes I, II, III, VI, and VII within the city, unless the same shall be equipped with fire escapes as follows:

(b) Every building four or more stories in height, except such as is used exclusively for a residence for one family shall have one or more incombustible sliding or stairway fire escapes, as required by this chapter, except as otherwise herein provided.

(c) There shall be at least one stairway fire escape constructed as required by the provisions of this chapter for each 250 persons, or fractional part thereof, who occupy any floor of any building habitually and daily or for whom working, sleeping or living accommodations are provided on any one floor above the third floor of any building or structure.

(d) Buildings of Ordinary Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 6,500 square feet or less, one 24-inch stairway fire escape.

With floor area of 6,500 square feet to 9,000 square feet, two 24-inch stairway fire escapes.

(e) Buildings of Mill or Slow-Burning Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 8,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 8,000 square feet to 12,000 square feet, two 24-inch stairway fire escapes.

(f) Buildings of Fireproof Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 10,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 10,000 to 20,000 square feet, two 24-inch stairway fire escapes.

With floor area of more than 20,000 square feet, three 24-inch stairway fire escapes.

(g) Fireproof Warehouse Buildings Shall be Equipped with Fire Escapes as Follows:

With floor area of 12,000 square feet or less, one 24-inch stairway fire escape.

With floor area exceeding 12,000 square feet, two 24-inch stairway fire escapes.

(h) A fireproof bridge built as described in Section 880 and connecting each floor of two neighboring buildings occupied by the same person, firm or corporation, shall be considered the equivalent of a fire escape, or of an interior stairway, but not the equivalent of both.

(i) In buildings of Class II there shall be a stairway or a fire escape as near as practicable to the end of each corridor, and where a corridor is endless the stairs and the fire escapes shall be located around and connected to said hall or corridor at distances approximately equal to each other.

(j) The openings leading to fire escapes on hospitals shall be flush with the floor leading to the fire escape which may be inclined not more than 2½ inches vertical to 12 inches of horizontal measurement, and shall be constructed and maintained with no obstructions thereon.

(k) In buildings hereafter erected wherever stairway fire escapes are considered the equivalent of an interior stairway or as taking the place of any of the "Width of Stairs" required by this chapter, there shall be a door or casement window leading to such fire escape from each floor. Windows and doors to such fire escapes shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such windows or doors shall not be more than 24 inches above the floor, unless a stair is built leading to the same.

(l) Where a building is divided into separate areas, each such area shall be considered as a separate building and shall be equipped with stairs and fire escapes as is required for buildings by this chapter, unless otherwise herein provided.

(m) Exterior stairway fire escapes built as required by this chapter and having treads not less than 10 inches wide from nosing to riser and risers not more than 8 inches in height and having stairways extending from the inside grade to the top floor of the building or having a counterbalance section from the first story to the ground and a steel ladder from the top landing to the roof, shall be considered the equivalent of one interior stairway and one stairway fire escape, if the width of such stairway fire escapes with that of one or more stairways in the building equals the "Width of Stairs" required for the area of the respective buildings by this chapter.

(n) Where a Fire Shield Stairway is constructed according to the following provisions and requirements, such Fire Shield Stairway shall be considered the equivalent of a stairway or stairways or a fire escape and stairway or stairways combined, as per the provisions of Paragraph "f" of this section.

The Fire Shield Stairway shall be divided or separated from the building by, and completely enclosed with, brick walls or walls of fireproof material not less than twelve inches thick, or by a wall of reinforced concrete and tile in combination not less than ten inches thick subject to the approval of the Commissioner of Buildings. The walls are to be built from the lowest floor level to and at least thirty-six inches above the roof, except as otherwise herein provided. The roof shall be built of fireproof construction. The stairs shall be of fireproof construction, and all door openings must be provided with fireproof thresholds, metal frames and approved incombustible doors. The risers of all stairs shall be not more than eight inches and the tread not less than nine inches, and winders in stairs shall not be permitted. The nearest riser of the stair in a downward direction must be remote from the entrance to the Fire Shield Stairway a distance not less than the width of the stairs. The entrance shall be by a fireproof vestibule or by an outside balcony. Said balcony shall be constructed on private property and shall not encroach on or overhang a public street or alley. Said vestibule or balcony shall be not less than five feet wide and the floors, ceiling and sides thereof shall be of fireproof material. One side of said Fire Shield Stairway shall face a street or alley or an open space leading directly to and connecting with a public street or alley. The side of said vestibule facing the street, alley or other open space, shall be open for the full width thereof from a point four feet above the floor to the underside of ceiling in each story.

The open space above said wall may be enclosed by a fire shield in the following manner only:

A metal frame constructed of steel of commercial shape, or a sheet metal frame filled with concrete, with a horizontal cross piece midway between the top and bottom of said frame, may be fitted in the opening flush with the inside face of the wall. This frame may be hung with two sashes, sash to be of metal and glazed with fire-resisting glass, hinged at the bottom and arranged to open out from the top, and restrained by angle iron or chain attached to the inner part of jambs of the opening, so as to allow sash to rest on same in an open position, in such a manner that the top edge of sash will be flush with the outer face of the wall. The mason work at the head of the wall opening shall be beveled off at an angle of forty-five degrees. The opening and closing of these sashes are to be controlled by a mechanical device to be approved by the Commissioner of Buildings. Where sash exceed five feet in width, intermediate piers of masonry sixteen inches wide by the breadth of wall in thickness may be built, and the resulting openings shall be each treated as hereinbefore stated. All metal sash and fire-resisting glass installed shall be subject to specifications and requirements elsewhere contained in this chapter.

The entrance from the building into the Fire Shield Stairway shall be through the vestibule or by means of the balcony only. All openings from the building to the balcony or vestibule and from the balcony or vestibule to the Fire Shield Stairway shall be not less than six feet nor more than seven feet in height and not less than four feet in width, and shall be provided with approved incombustible doors hung in metal frames and may be glazed with fire-resisting glass. In all cases, the floor of the vestibule or balcony, or floor landing of stairs, and the floor of the building containing Fire Shield Stairway shall be at the same level.

Where balconies are used as a means of access from the building to the Fire Shield Stairway, the floors of same shall be solid and built of fireproof material, and shall be of sufficient strength to sustain a load of one hundred pounds per square foot within the safe limits of stress for materials, as elsewhere specified in this chapter. Said balcony on each story shall be provided on the open side with an incombustible enclosure four feet high. There shall be a sufficient number of windows in the wall between the vestibule and stairway, or the doors to stairway shall be fitted with fire-resisting glass of sufficient area to properly light the said Fire Shield Stairway. All window openings shall be equipped with metal frames and sash and fire-resisting glass. The entire stairway, vestibule and balconies on all floors shall be provided with adequate means of illumination by gas or electricity on a separate circuit, and shall be lighted during all the time any part of the building in which they are located is being used after sunset or whenever lighting shall be required. The Fire Shield Stairway shall terminate at a landing on a level with, or not to exceed six inches above the street, alley or other open space on which faces; and access from said landing to said street, alley or other open space, shall be direct by means of an incombustible door or doors equipped with a metal frame and fire-resisting glass, not less than six feet nor more than seven feet in height, and not less than four feet in width. Connection to said Fire Shield Stairway from first floor will not be required if first floor has sufficient exits properly located. All doors to Fire Shield Stairway shall be of the style known as "double acting doors." In buildings other than skeleton construction a slip joint must be provided in the masonry walls between the tower and any wall connecting or abut-

ting thereto, subject to the approval of the Commissioner of Buildings.

Plans in detail, showing the construction and equipment and all other features of a Fire Shield Stairway shall be submitted in addition to the general plan showing the proposed location of same. Such details shall be drawn to an enlarged scale, and shall consist of a typical floor plan, a typical elevation and cross section of one or more stories and other stories which deviate from typical plan, and shall be approved by the Commissioner of Buildings before a permit for construction of same is issued.

(o) In buildings not more than two stories in height one stairway may be omitted if the building is equipped with a three-foot stairway fire escape built as required for fire escapes in this section with counterbalance drop and placed as far as practicable from the remaining stairway.

(p) Where fireproof buildings have a frontage upon public alleys or have courts of an area of not less than 320 square feet, and where such courts lead directly to a public thoroughfare, fire escapes may be erected on such courts or such alleys and shall not be required to be erected upon the street fronts of such buildings. Such fire escapes shall be located as far as possible from stairways in the buildings, and where it is possible to erect the fire escapes on an alley or in a court they may be thus erected subject to the approval of the Commissioner of Buildings.

(q) In fireproof buildings of Class IIa, fire escapes may be located in light courts of fifty feet in the least dimension, having no opening onto a street or alley, but such fire escape must be connected with a stairway of the building at a level no higher than twenty-five feet above finished grade at the building, said stairway to terminate at the first floor level in a public corridor, giving direct egress from the building.

(r) Such fire escapes shall not be considered as part of the width of stairs as defined in Section 878 of this chapter for such buildings unless that portion of the stairway used in connection with the fire escape is increased by the width of the fire escape, from their junction to the ground.

Hospitals two or more stories in height shall be provided with one or more stairway fire escapes not less than 40 inches between handrails. Sliding fire escapes shall have a radius or width of not less than 42 inches. Sliding fire escapes shall not be built on public thoroughfares and shall deposit the person from same not more than twenty-four inches from the surrounding ground, and sliding fire escapes on Class VIII buildings shall be constructed, located and maintained in accordance with the provisions relating to Class VIII.

Wherever stairway fire escapes are considered by this chapter to be the equivalent of an interior stairway or as taking the place of any of the width of stairs, there shall be a door leading to said fire escape from each floor. Such door shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such door shall not be more than 24 inches above the floor and the door shall be as wide as the stairway required on the fire escape. Where the sill is more than 24 inches from the floor, a small stairway shall be built from the floor to the window sill with treads not less than 10 inches wide and risers not more than 9 inches in height.

(s) A stairway fire escape placed on an exterior wall adjacent to a dividing or party wall shall be considered as a stairway fire escape for each building area to which it is adjacent. In such cases there shall be at least one door or window from each building area leading to the fire escape platform, and the width of each such fire escape shall not be less than 36 inches.

(t) All fire escapes shall be located and constructed to conform to the building for which they are respectively intended.

(u) If any building used wholly or in part for the purposes of Class VII be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such tier of bridges or passageways shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

(See Special Ruling VI, Page 303.)

882. **Stairway Fire Escapes—Fees—Erection of—Location—Component Parts.)** (a) The Commissioner of Buildings and his assistants shall determine upon the location of all stairway fire escapes before erection of same is commenced.

(b) Before the work is commenced a permit shall be obtained from the Commissioner of Buildings for which a fee of $2.00 shall be exacted.

(c) No permit for a stairway fire escape more than twenty-four inches in width shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or a structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said Commissioner.

(d) All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is possible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

(e) Anchors for a platform four feet two inches or less in width shall be made of one inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron with brace; over six feet shall be one and one-half inch square iron with brace. All anchors shall be turned up not less than eight inches at the outside of the platform on which to bolt the post.

(f) Braces shall be the same thickness as the anchors. The spread of the braces shall be the width of the platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of the platform.

(g) Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between buildings and railings. Platforms shall be not less than five feet in length. The frames and crossbars shall be made as provided in this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a stairway fire escape.

(h) All stairway fire escapes for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than 100 people on any one floor, shall be not less than two feet wide between hand

rails. Stringers for a 24-inch stairway fire escape shall not be less than 2 inches by ⅜ inch set 1½ inches apart. Where stairway fire escapes and their balconies and supports are designed and constructed in accordance with the provisions of this chapter relating to materials permitted for such stairway fire escapes, balconies and supports, so as to sustain a load of 100 pounds per square foot, they may be built of steel channels, angles, or I-beams, but when so constructed, they shall comply with the provisions of this chapter in all other respects. All stairway fire escapes for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall not be less than three feet wide in the clear, and all passageways shall not be less than three feet wide in the clear. Stringers for a 36-inch stairway fire escape shall be made of two bars, 3 inches by $\frac{5}{16}$ inch, about one inch apart, or 4½ inches by ⅜ inch flat iron, or of steel channels, angles or I-beams; where over 12 feet in length, they shall have anchor and brace in the center. The tread shall be made of one-half inch square steel or iron, corner upwards, not to exceed 1⅝ inches center, riveted at ends to 2 by $\frac{7}{16}$ inch flat iron or steel. There shall be not less than four bars to a tread where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length there shall be not less than six bars to a tread; there shall be a truss supporting treads made of bar iron 2 inches by ⅜ of an inch in thickness riveted to bars of treads in center, supported by not less than two inches by seven-sixteenths of an inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees. The rise shall be not more than nine inches and the tread not less than nine inches.

(i) All stairs shall have three bar railings made of one-inch bar iron for top rail, and three-fourths inch bar iron for lower rail, and when such stairs are more than three inches from the wall of the building, there shall be one or more hand rails on the wall side of such stairs.

(j) All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high, measured at right angles with the treads of such fire escapes, and shall have braces on the outside turned upwards and fastened to the frame of the balcony or stairs, which shall be not less than half way up the posts; all stair fire escapes shall extend to the ground either by counterbalance drop or stairs. All ladder fire escapes shall have either extension ladder or counterbalance drop from the first story of said building to the ground or sidewalk. All fire escapes if not continued to the roof shall be equipped with a ladder built in conformity with the specifications for ladder fire escapes contained herein from top story or attic platform to the roof. Their location, material and construction shall be subject to the approval of the Commissioner of Buildings. When cables are used for counterbalance stairs they shall not be less than three-quarters of an inch in size and shall be well oiled or greased when hung up and shall be oiled or greased at least twice a year. All pulleys and cables holding counterbalance drop shall be covered at bracket so as to be protected from snow or ice.

(k) Wherever a stairway fire escape passes a window or door on buildings hereafter erected, the windows or doors shall be of wired glass and shall have metal frames and sash, and whenever such a fire escape passes above a window, door or other opening not fitted with wired glass and metal frames the said fire escape shall be protected on the under side by sheet metal of not less than No. 20 United States gauge opposite such opening and for a distance of three feet on each side thereof. The use of intermediate platforms shall be permitted on all buildings now built or hereafter constructed whenever it is possible by their use to avoid the necessity of stairway fire escapes passing windows. All fire escapes shall be painted with two coats of mineral paint when erected, one at the shop and one upon completion at the building, and they shall be painted at least once every year thereafter.

(l) Wherever it is impossible to erect stairway fire escapes according to the provisions of this chapter, plans shall be submitted to the Commissioner of Buildings showing the location, material and construction of such stairway fire escapes as are proposed to be built before a permit is issued for the same, and if found to be impracticable to locate and construct fire escapes in accordance with the provisions of this chapter and that fire escapes built according to the plan presented would afford safe and practical means of exit from the building on which they are to be placed, then the Commissioner of Buildings may in his discretion approve the same. All such fire escapes shall be inspected by the Commissioner of Buildings on their completion and if found to be safe, satisfactory and in compliance with said approved plans, a certificate shall be issued to such effect upon the payment of $2.00 to the City Collector. All fire escapes other than such as it is impossible or impracticable to build in accordance with the provisions of this chapter shall be inspected by the Commissioner of Buildings on their completion, and if found to be in compliance with the provisions of this chapter a certificate shall be issued by the Commissioner of Buildings upon the payment of a fee of $2.00 to the City Collector.

(m) It shall be unlawful for any person, firm or corporation to use any building requiring fire escapes under the terms of this article until the provisions of this article shall have been complied with.

883. **Ladder Fire Escapes—When Permitted.)** Where a building of Class III or VI, not more than four stories in height has two flights of stairs leading from the ground to the top floor of the building and where also each occupant shall have access to at least two separate and distinct stairways located as required by the provisions of this chapter from the top floor to the ground, a ladder fire escape may be used in lieu of the stairway fire escape required herein, where a counter balance drop is placed from the ladder fire escape to the ground.

884. **Specifications for Ladder Fire Escapes.)** (a) All single and double ladder fire escapes hereafter erected shall be in strict accordance with the following provisions:

(b) There shall be not less than three one-inch square wrought iron anchors to every five-foot balcony and not less than six for a twelve-foot balcony. Such anchors shall pass through the wall of the building and be bolted on the inside with a three-fourths by two-inch nut and three and one-half inch iron washer back of the nut, where the wall is not over twenty inches thick; but where the wall is over twenty inches thick anchors shall be inserted at least eight inches into the wall at an angle of thirty-five degrees.

(c) Where a ladder fire escape is permitted by this chapter, the side guards shall be two by three-eighths inch flat iron. All ladder fire escapes shall be seventeen inches or more in width in the clear. No pipe nor rusted or defective material shall be used in the construction of ladder fire escapes. Rungs of ladders shall be of not less than one-half inch square iron with corners upward, so as to give a safe footing. Rungs

shall be riveted and shall be constructed with fourteen-inch centers.

(d) The brace for the anchors shall be at least twenty inches spread and shall extend into the wall four inches; no other form of anchor shall be allowed except by special permit from the Commissioner of Buildings.

885. **Balconies — Construction of.)** All balconies hereafter erected shall be either steel or wrought iron and capable of sustaining a weight of one hundred pounds to the square foot. The balcony frame shall be made of not less than two-inch by two-inch by one-fourth inch angle iron which shall be securely riveted together with crossbars every two feet. Such bars shall be punched one-half inch square close to the top of the bar on two inch centers and one-half inch square iron bars shall be forced through the same. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be two inch by three-eighths inch. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron and made to conform with the increased dimensions of iron in crossbars; for thirty-six inch balcony or more they shall be two and one-half inch by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of the balcony for the bars to rest upon; provided that such balconies and platforms of buildings of Class IIc may be built as described in Section 482 of this chapter. Such balconies shall have a substantial cast or wrought iron post every three feet bolted to the balcony. No balcony shall have less than three guard rails which shall be of wrought iron or new iron pipe not less than three-fourths inch in diameter and the ends shall be securely anchored to the wall of the building and shall be not less than ten inches on an angle of thirty-five degrees. Where stairway fire escapes and their balconies are designed and constructed in accordance with the provisions of this chapter to sustain a load of one hundred pounds per square foot, they may be built of steel channel angles or I-beams, but in such cases they shall comply with the requirements of this chapter in all other respects.

886. **Stairs and Fire Escapes—Change in Construction.)** No change in the position of any existing fire escape or stairway shall be made, nor shall any change in the position of any stairway or fire escape as shown on approved plans be permitted, unless the written consent of the Commissioner of Buildings shall first have been obtained.

ARTICLE XXI.

Elevators and Their Enclosing Walls.

887. **Elevator—Passenger and Freight—Permit for Construction.)** (a) Before proceeding with the construction or alteration of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, a permit for such construction or alteration shall be obtained from the Commissioner of Buildings either by the owner or agent of the building in which such elevator is to be constructed or in which such alterations are to be made, or by the contractor who is about to construct or alter such elevator.

(b) It shall be unlawful for any such owner, agent, or contractor to permit or allow the construction of any such elevator or the making of such alterations, or to proceed with or in or about any of the work of construction or alteration of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct, or the nature of the alterations to be made and the location of the building or structure in which the same is or are to be placed or made. Such application shall be accompanied with such plans and specifications as shall be necessary to advise and inform said Commissioner of the plan of construction, type of elevator, kind of alterations and the location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected or altered in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment of such applicant of a fee of two dollars for each elevator to be constructed, erected or altered, and such fee shall be known as a permit fee and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed, or of any alterations made.

888. **Fee.)** All contractors or persons, firms, or corporations, engaged in the manufacture and work of installing iron doors on passenger or freight elevators, or of installing wire work enclosures around elevators, shall secure a permit from the Commissioner of Buildings for the work on each such elevator, the fee for which shall be two dollars for each elevator in buildings of four stories or less in height, and in buildings of more than four stories in height fifty cents additional shall be charged on each elevator for every additional floor in excess of such four stories.

889. **Unlawful to Proceed Without Permit.)** It shall be unlawful for any person, firm or corporation either as owner, lessee, contractor or agent of any building or structure in which any elevator or elevators are to be constructed or altered to proceed with said work without securing a permit as herein required for such construction or alteration, and no such permit shall be issued until such person, firm or corporation, lessee, contractor or agent shall have complied with all the requirements of this chapter.

890. **Inclosure of Elevator Shafts in Non-Fireproof Buildings.)** In all non-fireproof buildings erected after March 13, 1911, all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such inclosure shall extend from the foundation to the roof of such building, and shall be supported independently of the floor construction; provided, however, that the requirements of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Chief Fire Prevention Engineer.

891. **Inclosure of Pits and Shafts in Basements.)** In all buildings heretofore or hereafter erected, not included in Section 890, whenever any elevator shaft extends down into a basment or sub-basement, that portion thereof extending below the level of the floor of the first story shall be inclosed in walls of brick, tile or other fireproof material, and the door openings in such enclosure shall be protected by incombustible doors. Where such elevator shafts do not extend down into the basement they shall be provided with fireproof pits at the lowermost floor level above which they serve, and such pits

shall have no openings except for cables or other elevator equipment.

892. **Inclosure of Dumb Waiter Shafts—Materials.)** In all non-fireproof buildings hereafter erected, the dumb waiter shafts shall be inclosed with brick, tile, reinforced concrete, or cement plaster not less than two inches thick or metal studs and lath.

893. **Doors—On Elevators.)** In all elevator shafts which are herein required to be enclosed with fireproof walls, the door openings shall be equipped with doors of incombustible material, which shall be made to open from the outside by means of a key or other device satisfactory to the Commissioner of Buildings.

894. **Hatch Doors — Freight Elevators.)** Elevators, used exclusively as freight elevators constructed and in operation at the time of the passage of this ordinance need not have enclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of a building in which such elevator is maintained to keep such hatch closers or doors at all times in good working order. Such automatic hatch closers shall be examined by the Commissioner of Buildings and the Chief Fire Inspection Engineer, and if said officials shall find that such doors will automatically close when the temperature at or near such doors exceeds 140 degrees Fahrenheit, and that the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and that in their construction or operation there is nothing that is likely to cause accidents or to interfere with the elevator service in such hatch holes which they were intended to close, and that the building in which such freight elevator is in use is equipped with stairways, fire escapes and passenger elevators sufficient to offer ample means of escape from such building in case of fire, for all persons employed or for all persons in such building, then, and in such case only, shall the use of such hatch doors or closers be permitted. All freight elevators in non-fireproof buildings shall comply with the preceding requirements of this section, or shall have inclosing walls of incombustible or fireproof construction. Such elevators are to be inspected semi-annually and oftener when, in the opinion of the Commissioner of Buildings, such inspection is necessary and such fees shall be paid for said inspection as otherwise provided in said chapter.

895. **Safety Device.)** (a) Every passenger and freight elevator now in operation or hereafter installed, except such as are hereinafter exempted from the provisions of this chapter, shall be provided with a speed governor and such other efficient device to secure the safe operation of such passenger or freight elevator, and to prevent the cab or car of such elevator from falling, and to secure the safety of the cab or car and its load in case it does fail, as may be required by the Commissioner of Buildings. Such speed governor and other devices shall be subjected to such a practical test as may be determined by the Commissioner of Buildings for the purpose of ascertaining the efficiency of such safety device.

(b) It shall be the duty of the Commissioner of Buildings to make such test of each and every device upon all elevators, and no elevator shall be permitted to be run until such test has been made.

(c) Whenever any accident shall occur causing injury to life or limb to any person, in or about an elevator, or while getting on or off an elevator, or which shall in any way impair the safety of the elevator, such accident shall be reported at once by the owner, superintendent, lessee or manager of the building, or the operator of the elevator, to the Commissioner of Buildings. No broken or damaged parts of such elevator shall be moved or displaced, nor shall repairs be made thereon, nor shall said elevator be operated until an investigation into such accident has been made by the Commissioner of Buildings or his duly authorized agent. A full report in writing of the result of such invetigation shall be filed in the Department of Buildings, and the Commissioner of Buildings shall keep a complete record of all such accidents and reports thereon.

(d) It shall be unlawful for any operator of any elevator in the City wherein passengers are conveyed to start such elevator until all doors of such elevator and leading into such elevator shall be closed. It shall be unlawful for any such operator to open any of the doors of such elevator until said elevator has come to a full stop.

(e) Any person, firm or corporation violating any of the provisions of this section, or failing or neglecting to comply therewith, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

896. **Safeguards for Elevators.)** (a) Where the counterweights travel in the same hatchway with an elevator car, the portion of the car contiguous to the weights shall be protected from the top to the bottom of the car by a suitable guard.

(b) All freight elevators shall be provided with a guard at least six feet high. All elevator cabs or cars, whether used for freight or passengers, shall be provided with some device whereby the car or cab may be held in the event of accident to the shipper rope or hoisting machinery or controlling apparatus.

(c) No passenger elevator hereafter erected shall be installed with a freight compartment either below or above the car.

(d) All hoistways, hatchways, elevator wells and wheel holes in any building, whether occupied or vacant, shall be securely fenced, inclosed or otherwise safely protected, and it shall be the duty of the owner, occupant or agent of any such building to keep all such means of protection closed at all times, except when it is necessary to have the same open, in order that the said hatchways, elevators or hoisting apparatus may be used.

(e) It shall be unlawful to erect or maintain an elevator where such elevator or its counterweight descends into any passageway or thoroughfare.

(f) There shall be directly under the sheaves at the top of every elevator hatchway, a grating of steel or heavy wire mesh properly supported by steel or iron and capable of sustaining a load of not less than 500 pounds.

(g) All counterweights hereafter installed shall have their component parts so fastened together as to prevent any piece or pieces from becoming detached from the guides should the counterweights be accidentally drawn to the top of the hatchway.

(h) Where drum counterweight cables run through or pass by the car counterweights to weights underneath, they shall be provided with a suitable covering to prevent their chafing and wearing on the counterweights.

(i) Where elevators other than handhoists and sidewalk elevators are not inclosed with fireproof or incombustible ma-

terial, as is elsewhere herein specified in this Article, the well-hole of such elevator shall be enclosed with a wire guard not less than six feet high. The counterweights and the immediate space through which they travel must be protected from the floor to the ceiling with a wire guard or with other incombustible material. There must be on all elevators hereafter constructed a clear space of not less than two feet between the bottom of the hatchway and the level of the lower floor landing when the car is at its lowest position, and there must be a clearance of at least four feet from the top of the crossbeam of the car to the lower side of the grating under the overhead sheaves. Whenever there is conflict in regard to the manner of enclosing any elevator shaft or portion thereof between this section and Sections 890, 891 and 892, the provisions of the latter sections shall prevail.

(j) All passenger and freight elevators hereafter installed, except sidewalk or hand elevators, shall have an artificial traveling gas or electric light attached to the car and maintained in good working condition.

(k) All power driven elevators hereafter constructed or installed shall have at least two hoisting cables for the cage and two cables for each counterweight. The lifting and counterweight cables shall have at least one full turn of the cable on the drum when the car has run its limit.

(l) It shall be unlawful to change a hand-hoist to a power-driven elevator without first making application to the Commissioner of Buildings for a permit for such change, and it shall be unlawful to connect an electric motor or any other appliance to the hand elevator machinery without the approval of the Commissioner of Buildings.

(m) All elevators, except hand elevators operated by a pulley rope and sidewalk ram or chain hoist elevators, and elevators used in tunnels for freight service only, shall be equipped with a safety speed governor.

(n) Where ropes or cables are used to operate safety devices, a weight shall be properly attached to the same in such a manner as to insure the necessary tension on such rope or cables for proper performance of the safety devices.

(o) All elevators propelled by electricity shall be provided with an additional device not operated by link or sprocket chain which will automatically stop the elevator machinery when the car has reached its limit of travel. It shall be unlawful to construct or maintain any elevator equipped with a sprocket chain or link belt device or devices connecting the operating device and controller.

(p) An emergency switch which will disconnect the current shall be provided in all passenger elevators hereafter installed which are operated by an electric controller car switch, and such cars shall be so constructed that they will automatically stop when the current is disconnected.

(q) The underside of the floors or other parts of a building which project into passenger elevator shafts shall be equipped with a smooth steel guard curved and sloped from the enclosure of said elevator to the edge of such projection for the width of the door to such elevator car and the slope of the guard plate shall not be less than sixty degrees with the horizon.

(r) The provisions of this section requiring the equipment of elevators with safety devices shall not apply to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction, but the Commissioner of Buildings shall make such reasonable requirements as he may deem necessary for public safety in the operation of such hand hoists, elevators or hoists used solely for hoisting materials or tools in such buildings while under construction.

897. **Inspection—Test—Certificate to Be Posted.)** (a) Every elevator now in operation or which may be hereafter installed, together with the hoistway and all equipment thereof, shall be inspected under and by the authority of the Commissioner of Buildings at least once every six months, and in no case shall any new elevator be placed in operation until an inspection of the same has been made.

(b) It shall be the duty of every owner or agent, lessee or occupant of any building wherein any elevator is installed and the person in charge or control of any elevator to permit the making of a test and inspection of such elevator or elevators and all devices used in connection therewith upon demand being made by the Commissioner of Buildings or by a duly authorized Elevator Inspector within five days after such demand has been made.

(c) Whenever any such elevator has been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped and the result of such inspection and tests shows such elevator to be in good condition, satisfactory to the Commissioner of Buildings, and that such safety devices have been provided in accordance with the requirements of this chapter and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings to issue or cause to be issued a certificate setting forth the result of such inspection and tests and containing the date of inspection, the weight which the elevator will safely carry and a statement to the effect that the shaft doors, hoistway and all equipment, including safety devices, are constructed in accordance with the provisions of this chapter, upon the payment of the inspection fee required by this chapter.

(d) It shall be the joint duty of the owner, agent, lessee or occupant of the building in which such elevator is located and of each person in charge or control of such elevator to frame the certificate and place same in a conspicuous place in each elevator.

(e) The words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

(f) Where the result of such inspection or tests shall show such elevator to be in an unsafe condition or in bad repair, or shall show that the safety devices, or any of them, which are required by this chapter, have not been installed, or if installed, are not in good working order or not in good repair, such certificate shall not be issued until such elevator, its hoistway and its equipment or such device or devices shall have been put in good working order, satisfactory to the Commissioner of Buildings. The inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

898. **Power of Commissioner to Stop Operation of Elevators.)** (a) Whenever any building or elevator inspector finds any passenger or freight elevator or any of its running parts or automatic devices or other equipment out of order, or in an unsafe condition, he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

(b) It shall be the duty of the Commissioner of Buildings upon receiving from any inspector a report of the unsafe condition

of any elevator, to order the operation of such elevator to be stopped, and to cause such elevator not to be used until the same shall have been placed in a safe condition, and it shall be unlawful for any owner, agent, lessee, or occupant of any building, wherein any such passenger or freight elevator is located within the city, to permit or allow any such elevator to be used after the receipt of a notice in writing from the Commissioner of Buildings that any such elevator is out of order or is in an unsafe condition and until said elevator has been put in a safe and proper condition as required by the provisions of this chapter.

ARTICLE XXII.

Building Contractors.

899. **Building Contractors—Registry with Department of Building.)** That every person, firm, or corporation engaged in the business of constructing or repairing the whole or any part of buildings or the appurtenances thereto in the City of Chicago, shall before undertaking the erection, enlargement, alteration, repair or removal of any building, for which permits are required by the ordinances of the City, register the name and address of such person, firm, or corporation in a book kept by the Commissioner of Buildings and used for this purpose.

No permit shall be granted for the erection, enlargement, alteration, repair or removal of any building unless the name and address of the person, firm, or corporation that is about to undertake the work of construction on such buildings is contained in the registration book kept for that purpose.

900. **Where Masonry Work Only is Required.)** When application is made for a permit and the work of construction involves masonry construction only the above provisions shall not apply to any person, firm or corporation licensed as a mason contractor or employing mason as provided in and by the ordinances of the City. Where the work of construction, for which a permit is sought involves construction other than masonry construction, any mason contractor or employing mason, licensed as aforesaid, engaged in or undertaking the work of such construction other than masonry construction must register his, their or its name or names and comply with the other requirements of this article before a permit for such work is issued.

901. **Liability for Violations.)** If any person, firm or corporation that is so registered shall fail, in the execution of any work for which a permit was issued, to comply with the ordinances of the City relative to the erection, enlargement, alteration, repair or removal of any building, either the Commissioner of Buildings or the Commissioner of Health may bring suit and prosecute such person, firm or corporation for such failure or violation, and in case of conviction, his, their or its name or names shall be stricken from the said registration book and shall not be re-entered or reinstated during such time as any violation exists or any judgment remains unsatisfied with regard to said conviction.

902. **Reinstatements.)** Any person, firm or corporation that shall have been convicted under the preceding section and had his, their, or its name or names stricken from such registration book may have such name or names re-entered on filing with the Commissioner of Buildings a certificate signed by the City Prosecutor, the Commissioner of Buildings and the Commissioner of Health to the effect that all violations of ordinance with reference to which conviction was secured, have been corrected and are nonexistent and that all claims and judgments arising from such convictions have been paid.

ARTICLE XXIII.

Billboards, Signboards, Signs, and Fences.

903. **Billboards and Signboards on Buildings—Construction—Height.)** No billboard or signboard shall be erected or placed upon or above the roof of any building or structure within the limits of the City of Chicago; and it shall be unlawful for any person, firm or corporation to attach any billboard or signboard to the front, sides, or rear walls of any building, unless the same shall be placed flat against the surface of the building and safely and securely anchored or fastened thereto in a manner satisfactory to the Commissioner of Buildings.

904. **Size and Construction of Billboards and Signboards Erected Within Fire Limits Otherwise Than on Buildings.)** The face of billboards or signboards erected within the fire limits as now defined or as they may hereafter be defined by ordinances of the City of Chicago other than signboards and billboards referred to in Section 906 hereof, shall not exceed twelve feet in height, and the same shall be constructed of galvanized iron or some other equally incombustible material, except that the stringers, uprights and braces thereof may be of wood. All such billboards or signboards shall be securely anchored or fastened so as to be safe and substantial.

905. **Height and Distance From the Ground of Billboards and Signboards Erected Within the Fire Limits.)** It shall be unlawful for any person, firm or corporation to construct or erect any billboard or signboard, except those specified in Section 906 hereof, within the fire limits of the City of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street or streets has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The face of every billboard or signboard within the fire limits shall be of incombustible material, but the supports and framework of the same shall be of wood. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. Every such billboard or signboard must be constructed and located in accordance with the provisions of this Article and shall be subject to the approval of the Commissioner of Buildings.

906. **Wooden Billboards or Signboards—Construction—Size—Exceptions.)** Billboards or signboards not exceeding twenty-four (24) square feet in area when attached to the front, sides, or rear walls of any building, so that the flat surface of same is against the building, or when erected on the ground, if not erected nearer than ten feet to any building, structure, other signboard or public sidewalk, which are used to advertise the sale or lease of the property upon which they shall be erected, may be built of wood or other combustible material, and such billboards or signboards shall be exempt from the provisions of this article, except that they shall be safely and securely anchored or fastened and shall be so constructed, anchored and fastened that they will withstand the wind pressure specified in Section 911 of this Article. It shall be unlawful to erect any such billboard or signboard exceeding twenty-four (24) square feet in area before a permit therefor has been procured

from the Commissioner of Buildings, the application for which must include the plans and specifications of such board and its supports and fastenings.

907. **Billboards and Signboards Erected Outside the Fire Limits—Construction—Size.)** It shall be unlawful for any person, firm or corporation to construct, erect or locate any billboard or signboard, except those specified in Section 906 hereof, outside the fire limits of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. The braces, supports and face of the billboard or signboard outside the fire limits may be made of wood, unless the billboard or signboard shall be erected or located so that any part of the face of said board is nearer than ten feet to any building or structure in which case the face of the same shall be constructed with incombustible material. Every such billboard or signboard shall be safely and securely constructed, anchored, fastened and located in accordance with the provisions of this article and shall be subject to the approval of the Commissioner of Buildings.

908. **Provisions of This Article Shall Apply to Other Similar Structures.)** The provisions of this article shall apply to other similar structures of like size and construction without regard to their use whether erected on or near the surface of the ground or anchored to, or fastened to any building or structure.

909. **Permit for Billboard or Signboard.)** No billboard or signboard or other similar structure such as is described in this article shall be erected or maintained within the city unless a permit shall first have been secured by the person, firm or corporation desiring to erect or maintain such billboard or signboard from the Commissioner of Buildings to whom application for such permit shall be made; and such application shall be accompanied by such plans and specifications of the proposed billboard or signboard and location of same as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or signboard. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection of such billboard or signboard upon the payment by the applicant of a fee as hereinafter fixed.

910. **Alteration and Repair of Billboards and Signboards.)** No material alteration of any billboard or signboard nor removal from one location to another shall be made except upon a written permit issued by the Commissioner of Buildings authorizing such alteration or removal; and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or signboard or by the person in charge, possession or control thereof, accompanied by a plan of the proposed alterations or repairs to be made and a written statement covering the proposed removal from one location to another and its reconstruction in the new location, which said alteration and repairs or removal shall be made in accordance with the provisions of this article and the ordinances of the City of Chicago. Where such plans, specifications and location are in compliance with the requirements of this article and are satisfactory to and approved by the Commissioner of Buildings, such Commissioner shall issue a permit upon the payment of a fee therefor as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

911. **Wind Pressure—Strength.)** All billboards and signboards now in existence, or hereafter to be constructed, erected or maintained, shall be made, constructed, erected and maintained of sufficient strength to withstand a wind pressure of twenty-five pounds per square foot of surface without stressing the material beyond the safe limit of stress given elsewhere in this chapter.

912. **Height of Billboards and Signboards.)** No surface billboard or signboard constructed or erected prior to the passage of this ordinance shall be maintained after six months from and after the passage of this ordinance where the height of such billboard or signboard exceeds seventeen feet, nor shall such billboard or signboard be maintained after such date, unless there is a clear space of at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is erected or maintained is above the level of the street there must be a clear space of at least three feet between the bottom or face of the billboard or signboard and the level of the ground at the point where the billboard or signboard is erected or maintained.

913. **Duty of Commissioner—Owner's Name to Be Placed on Top of Billboard or Signboard—Annual Inspection.)** It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboard or signboards are such as will serve to protect the public and to render such billboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise supervision over all billboards and signboards erected or being maintained under the provisions of this article; and to cause inspection by inspectors in his department of all such billboards and signboards to be made once each year and oftener where the condition of such boards so require; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this article or is in an unsafe condition or has become unstable or insecure or is in such a condition as to be a menace to the safety or health of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person, firm or corporation of the violation of this article and the dangerous condition of such billboard or signboard and directing him to make such alterations or repairs thereto, or to do such acts or things, as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition and to make the same comply with the requirements of this article within such reasonable time as may be stated in said notice. If the owner or person in charge, possession or control of any billboard or signboard when so notified shall refuse, fail, or neglect to comply with

and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time therein mentioned, alter, change, tear down or cause to be torn down such part of such billboard or signboard as is constructed and maintained in violation of this article, and shall charge the expense to the owner or person in possession, charge or control of such billboard or signboard and the same shall be recovered from such owner or person by appropriate legal proceedings. If the owner of such billboard or signboard or the person in charge, possession or control thereof cannot be found, or his or their whereabouts cannot be ascertained, the Commissioner shall attach or cause to be attached to said billboard or signboard, a notice of the same import as that required to be sent to the owner or person in charge, possession or control thereof, where the owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and be placed in a secure, safe and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon cause such billboard or signboard or such portion thereof as is constructed and maintained in violation of this article to be torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measure as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which shall be charged to and recovered from the owner of such billboard or signboard or person in charge, possession or control thereof in any appropriate proceedings therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession or control thereof. It shall be the duty of the Commissioner of Buildings to require that the name of the person or corporation owning or in possession, charge or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession or control thereof shall fail or refuse to place and maintain such name on the same, such owner or person shall be subject to the penalty hereinafter provided for. Every person, firm or corporation engaged in the business of erecting billboards or signboards for the purpose of display advertising shall file with the Commissioner of Buildings within ninety days after the passage of this ordinance a full and complete report of the location and size of all existing billboards or signboards unless such record is already in the possession of the Commissioner of Buildings.

914. **Fees for Permits and Annual Inspection—Indemnifying Bond.)** (a) The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be five dollars for each twenty-five lineal feet of billboard or signboard erected or altered. An annual fee of one dollar for each twenty-five lineal feet of billboard or signboard, or fractional part thereof shall be charged every person, firm or corporation as owner, or in possession, charge or control of any billboard or signboard for inspection of such billboards or signboards; provided, however, that where such signboard does not exceed sixty-five square feet in area and is attached to the surface of a permanent building in accordance with the provisions of Section 903 and is designed to give publicity to the business carried on within such building, and no part of said sign is more than eighteen feet above the average inside grade at the front of the building, no fees for erection or inspection shall be charged; but not more than one sign of sixty-five square feet shall be allowed for each twenty-five lineal feet of frontage, unless the fees for erection and inspection are paid as herein provided for.

(b) Every person, firm or corporation engaged in the business of constructing and erecting billboards or signboards shall file with the City Clerk a bond, with sureties to be approved by the Commissioner of Buildings, in the penal sum of twenty-five thousand ($25,000.00) dollars, conditioned that such person, firm or corporation shall faithfully comply with all the provisions and requirements of this article with respect to the construction, alteration, location and safety of billboards or signboards and for the payment of the inspection fees required by this article; and conditioned, further, to indemnify, save and keep harmless said City of Chicago and its officials from any and all claims, damages, liabilities, losses, actions, suits or judgments which may be presented, sustained, brought or secured against the City of Chicago or any of its officials on account of the construction, maintenance, alteration or removal of any of said billboards or signboards, or by reason of any accidents caused by or resulting therefrom.

915. **Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to erect or construct any billboard or signboard in any block on any public street in which one-half of the buildings on both sides of the street are used exclusively for residence purposes without first obtaining the consent in writing of the owners or duly authorized agents of said owners owning a majority of the frontage of the property on both sides of the street in the block in which such billboard or signboard is to be erected, constructed or located. Such written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the erection, construction or location of such billboard or signboard.

916. **Penalty.)** Any person, firm or corporation owning, operating, maintaining or in charge, possession or control of any billboard or signboard within the city, who shall neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article in all cases where no specific penalty is fixed herein, shall be fined not less than twenty-five ($25.00) dollars nor more than two hundred ($200.00) dollars for each offense; and each day on which such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

917. **Fences—Permit Fee.)** It shall be unlawful for any person, firm or corporation to erect or construct any fence within the city limits without first obtaining a permit from the Commissioner of Buildings. No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. The fee to be charged for permits for the erection or construction of fences shall be one dollar for each one hundred lineal feet of fence.

918. **Fences—Walls—Height of—Wind Resistance.)** No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is

established. No fence of any other material shall be constructed on a lot alongside a street or alley or within eight feet of such street or alley and parallel thereto of greater height than eight feet above the surface of th street or alley where a grade is established or eight feet above the surface of the street or alley where no grade is established. No single or isolated wall of any material whatever, which forms no part of a building or structure that may be lawfully erected, shall be constructed upon any portion of a lot where the distance from such wall to the lot line is less than the height of the wall, unless such isolated wall shall have lateral supports on at least one side of same with braces extending to the top of the wall and is so constructed that it shall be capable of resisting a horizontal wind pressure on every part of same twice as great as buildings under the provisions of this ordinance must be designed to resist.

In all cases where a fence or wall has been or shall hereafter be erected contrary to the provisions of this section, the Commissioner of Buildings shall forthwith notify the owner or agent of the land on which same is located, or the contractor engaged in erecting same, and shall specify briefly in such notice in what manner such fence or wall violates the provisions of this section, and the said Commissioner of Buildings shall require the person so notified to forthwith make such fence or wall conform to and comply with the provisions of this section, specifying in such notice the time within which such work shall be done.

If at the expiration of the time set forth in the notice provided for in this section, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and shall not have torn down or changed the said fence or wall so as to conform to and comply with the provisions of this section, the Commissioner of Building shall have authority and it shall be his duty to proceed forthwith to tear down, or cause to be torn down, such fence or wall or so much thereof as is being maintained or shall have been erected and constructed in violation of the provisions of this section, and the cost of such tearing down shall be charged to and recovered from the owner of such fence or wall or from the person for whom such fence or wall have been or is being erected.

(See Special Ruling VII, Page 303.)

919. **Illuminated and Other Roof Signs of Steel Skeleton Construction—Definition—General Requirements — Fees.)** (a) Illuminated and other roof signs regulated by this section shall be defined as signs constructed, erected and maintained upon or over the roof of any building which have all or any part of its letters of which said signs may be constructed either in an outline of incandescent lamps or which have painted, flush or raised letters where the face of the sign presents a surface to be affected by wind pressure not in excess of the requirements hereinafter contained; or signs having a border of incandescent lights attached thereto and reflecting light thereon; or transparent glass signs where they are lighted by electricity or other illuminant. Every such sign as hereinabove described shall be constructed with steel skeleton construction so as to present a surface to be affected by wind pressure which shall not exceed fifty per cent. of the face of the sign. No illuminated roof sign shall be erected or maintained upon or over the roof of any building unless the framework thereof shall be entirely of metal or some other equally incombustible material, and no material, except such material as is used for insulating wires and conductors, which is less combustible than metal, shall be used in, on or about, or comprise a part of any illuminated roof sign, except that the material to which the framework of any such sign shall be anchored, may be substantial beams anchored or securely fastened to the roof or walls of the buildings upon or over which any such sign is erected.

(b) The distance between the roof of said building or structure and the lower edge of such sign shall not be less than five (5) feet. The height of any such sign from the roof of the building or structure to which the same is anchored or attached shall not exceed sixty (60) feet. No such sign, hereafter erected, shall be constructed closer than six (6) feet from the edge of the roof of the building or structure upon which same is erected. No such illuminated roof sign shall be constructed on any building or structure which is over eight stories in height. In case of illuminated roof signs less than twelve (12) feet in height, the permit fees and inspection fees shall be the same as for billboards, and signboards and the provisions for such fees in this section shall not apply. No illuminated roof sign, such as is described in this section, shall be constructed, erected, maintained or put in place until the person, firm or corporation desiring to construct, erect, maintain or put in place such sign shall have made application in writing to the Commissioner of Buildings for permission so to do, submitting with such application plans and specifications showing the size, nature and construction of the sign proposed to be erected, and shall present to the City Electrician plans showing the insulation, location and construction of the electrical part of such sign. If the Commissioner of Buildings shall be of the opinion that such sign, if erected, constructed and maintained in accordance with the plans and specifications so submitted, shall be safe and secure, he shall approve the application so submitted, providing the plans bear the approval of the City Electrician, and the Commissioner of Buildings shall note his approval upon such plans and specifications and keep a copy thereof at all times on file in his office. All signs shall be constructed, erected and maintained of sufficient strength to withstand a wind pressure of not less than thirty pounds per square foot of surface without stressing the material beyond the safe limits of stress given elsewhere in this chapter. It shall be the duty of the Commissioner of Buildings to cause his building inspector or inspectors to make an inspection annually of each illuminated roof sign erected or constructed or being maintained under the provisions of this ordinance for the purpose of ascertaining whether such sign is safely and securely constructed and so anchored and fastened to the building or structure; provided, however, that the provisions of this section shall not apply to the erection, construction and maintenance of signboards and billboards as regulated by the ordinances of the City of Chicago.

(c) Any person, firm or corporation desiring to erect or maintain an illuminated roof sign, as described in this section, shall pay to the city, to cover the cost of inspection and approval by the Commissioner of Buildings of the plans and specifications of such sign, when erected, a fee of fifty dollars for the first five hundred square feet of superficial area of such sign or fractional part thereof, and five cents for each additional square foot. For each annual inspection of any illuminated roof sign by the Commissioner of Buildings, subsequent to the first inspection, there shall be paid a fee of fifty dollars for the first five hundred square feet or fractional part; five cents additional for each additional square foot area over five hundred square feet. In addition to the fees herein required to be paid for inspection, there shall be paid by the owner or person having charge or control

of any illuminated roof sign, as herein described, an annual inspection fee to cover the cost of such inspection, which shall be made by the Commissioner of Gas and Electricity, whose duty it shall be to cause such annual inspection to be made, and such fee shall be at the rate provided by the ordinances of the city.

(d) Every illuminated roof sign erected, constructed or maintained under the provisions of this ordinance shall have the name of the owner thereof placed thereon in a legible and conspicuous manner. No person, firm or corporation shall be permitted to erect or maintain an illuminated roof sign unless he shall execute and file with the City Clerk of Chicago, with sureties to be approved by the Commissioner of Buildings, a bond to the City of Chicago in the penal sum of fifteen thousand dollars ($15,000.00), conditioned to indemnify, save and keep harmless the City of Chicago, and its officers and agents, from any damage which it, the said city, or any of said officers, may suffer, or from any costs, liability or expense of any kind whatsoever which it, the said city, or any of its officers, may be put to or which may be recovered against the said city, or any of its officers, from or by reason of the construction, erection and maintenance of such sign, and conditional further to faithfully observe and perform all the provisions and conditions of this article and of any ordinance now in force or which may hereafter be passed by the City Council of the City of Chicago, relating to or governing the erection, maintenance, use or inspection of illuminated roof signs.

(e) The permission and authority granted by this article shall cease at any time hereafter at the discretion of the Mayor. In case of the termination of the priviliges herein granted by the exercise of the Mayor's discretion as aforesaid, all such electrical signs erected by virtue of the authority conferred by this article, shall be removed at the expense of the owner or owners of the building or the person, firm, corporation or individual who are then maintaining same without any cost or expense of any kind whatsoever to the City of Chicago, provided that in the event of the failure, neglect or refusal on the part of the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating and maintaining said electric sign to remove said electric sign upon the revocation of the permit by the Mayor as herein provided, the Commissioner of Buildings may proceed to remove same and charge the expense thereof to the owner of the building or structure upon which said illuminated electric sign is constructed or to the person, firm, corporation or individual operating or maintaining same.

(f) Any person, firm or corporation who shall erect, construct or maintain an illuminated roof sign in violation of any of the provisions of this section shall be fined not less than fifty dollars ($50.00) nor more than two hundred dollars ($200.00) for each offense.

ARTICLE XXIV.

Frontage Consents.

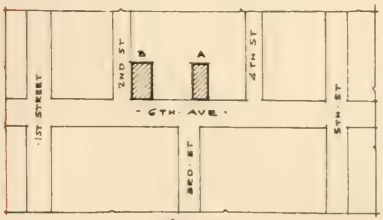


Fig. 52.

920. **Definition of Word "Block.")** Whenever a provision is made in this chapter that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specially provided.

921. **Frontage Consents—Where Required—Uses of Property for Required—Consent in Writing.)** It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the City in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, or within fifty feet of any such street, any building, structure or place used for a gas reservoir, manufacture of gas, stock yards, slaughter house, packing house, smoke house or place where fish or meats are smoked or cured, soap factory, glue factory, size or gelatine manufactory, renderies, fertilizer manufactory, tannery, storing or scraping of raw hides or skins, lime kiln, cement or plaster of Paris manufactory, oil cloth or linoleum manufactory, rubber manufacture from the crude material, saw or planing mill, wood working establishment, starch factory, glucose or dextrine manufactory, textile factory, laundry run by machinery, factory combined with a foundry, iron or steel works, brass or copper works, sheet metal works, blacksmithing or horseshoeing shop, boiler making, foundry, smelter, metal refinery, machine shop, stone or monument works run by machinery, asphalt manufacture or refining, paint and varnish factory, oil or turpentine factory, printing ink factory, tar distillation or manufacture, tar roofing, tar paper or tarred fabric manufactory, ammonia or chlorine or bleaching powder factory, celluloid manufactory, place for the distillation of wood or bones, lamp black factory, sulphurous acid, sulphuric acid, nitric or hydrochloric acid manufacture, factories or other manufacturing establishments using machinery or emitting offensive or noxious fumes, odors or noises, storage warehouses storing or baling of junk or scrap paper or rags, shoddy manufacture or wool scouring, second-hand store or yard, incineration or reduction of garbage or offal, dead animals or refuse, stable for more than five horses, medical dispensary, livery stable, sale stable, boarding stable, without the written consent of a majority of the property owners according to frontage on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building, structure or place for any of the above purposes: provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street located upon a corner lot shall not be considered.

922. **Reformatories — Sheltering Institutions.)** It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which one-half of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution or the grounds thereof may have frontage, are used exclusively for residence purposes without the written consent of a majority of the property owners, according to front-

age on both sides of the streets bounding such square. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction, alteration, or maintenance of such building. Provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

923. **Permit For Moving Frame Buildings — Requirements — Written Consents — Space Occupied on lot.)** (a) No person, firm or corporation shall be permitted to move any building which has been damaged to an extent greater than 50 per cent of its value by fire, decay or otherwise; nor shall be permitted to move any frame building of such character as is prohibited to be constructed within the fire limits from any point outside the fire limits to any point within the fire limits; nor shall it be permissible to move any building to a location at which the uses for which such building is designed are prohibited by ordinance. Permits for the moving of frame buildings other than those the moving of which is herein prohibited, shall be granted upon the payment of a fee of ten cents for each one thousand cubic feet of volume or fractional part thereof of such building, and securing and filing the written consent of two-thirds of the property owners according to frontage on both sides of the street in the block in which such building is to be moved. No permit shall be issued to move any building used or designed to be used for purposes for which frontage consents are required until frontage consents in the block to which such building is to be moved have also been secured and filed as required by the ordinances relating to such use.

(b) No building used for residence or tenement house purposes shall be moved from one lot to another or from one location to another upon the same lot unless the space to be occupied on such lot shall comply with the provisions of Section 642 of this chapter.

(c) No frontage consent shall be required of any person, firm or corporation for removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

924. **Amusements — Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to construct or erect any building or structure designed or intended to be used for the purpose of presenting or carrying on therein any entertainment for which a license is required by the ordinances of the City of Chicago or to devote any grounds or place to such purposes without first obtaining the written consent of the property owners as required by the City ordinances.

925. **Buildings for the Storage of Shavings, Sawdust and Excelsior—Frontage Consents.)** It shall be unlawful for any person, firm or corporation to construct or erect any building designed or intended to be used for the purpose of storing shavings, sawdust or excelsior therein within the city without first obtaining the written consent of the property owners as required by the City ordinances.

926. **Frontage Consents — Business of Selling Provisions, Etc., in Residence Districts.)** It shall be unlawful for any person, firm or corporation to carry on the business of selling meats, poultry, fish, butter, cheese, lard, vegetables or any other provisions from any place of business located in any block in which all the other buildings are used exclusively for residence purposes, without first securing and filing with the City Collector the written consent of three-fourth of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located, provided in determining whether all the buildings in said block are used exclusively for residence purposes, any building fronting on another street and located upon a corner shall not be considered. In case a permit for building a store for such purposes in such block, or converting a building to store purposes in such block is applied for, the frontage consents required by this section shall be filed with the Commissioner of Buildings.

927. **Business of a Store—Requirements at to a Permit for Erection.)** No permit shall be issued for the erection or remodeling of any building in any block in which the use of buildings is restricted or regulated by ordinance if such building is designed to be used for conducting therein any business or store, without first requiring the applicant for such permit to file with the Commissioner of Buildings a plat showing the use to which all the property in such block is devoted.

928. **Withholding of Building Permit—Protest of Property Owners—Public Hearing—Definition of Word "Square".)** In all cases where an application for a permit is made for the erection of a new building in any square in which a majority of the buildings are used exclusively for residence purposes, or in a square on the opposite side of the street from such square so used for residential purposes; if there shall be filed with the Commissioner of Buildings a protest signed by not less than ten owners of property in such square so used for. residential purposes, or in case the ownership of the frontage is in less than twenty persons then by a majority of the owners according to frontage, the Commissioner of Buildings shall withhold the issuance of the permit until the City Council shall have ordered a public hearing similar to that required in an act of the general assembly entitled "An Act to confer certain additional powers upon city councils in cities and presidents and boards of trustees in villages and incorporated towns concerning buildings and structures, the intensity of use of lot areas, the classification of trades, industries, buildings and structures with respect to location and regulations, the creation of districts of different classes, and the establishment of regulations and restrictions applicable thereto," in force June 28, 1921. For the purposes of this section a square shall be understood to be a plot of ground containing city lots surrounded by public streets, railway right of way, natural boundaries, or public places or thoroughfares.

929. **Garages — Frontage Consents Required.)** No person, firm or corporation shall keep, conduct or operate a garage in this city without first obtaining a license so to do in the manner provided for in this ordinance; and it shall not be lawful for any person, firm or corporation to locate, build, construct or maintain any garage within the territory bounded by the Chicago River and the south branch thereof on the north and west, by Lake Michigan on the east and by Van Buren Street on the south, any part of which is within eighty feet, or the entrance or exit to or from which, for the use of automobiles, is either within one hundred and sixty feet, of any portion of the street front of any building used as and for a hospital, church or public or parochial school, or such entrance or exit of which is upon a street containing street car tracks, and within one (1) block of the entrance of a street railway tunnel, or which shall house within said distance of one hundred and sixty feet of such street front, more than seventy-five cars. It shall not be lawful to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church or public or parochial school, or the ground thereof, in

any portion of the City of Chicago outside of the territory above named, nor shall any person, firm or corporation locate, build, construct or maintain any garage in the city on any lot in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of any such street in any such block, without the written consent of a majority of the property owners according to frontage on both sides of the street; provided that all lots which abut only on a public alley or court shall be considered as fronting on the street to which such alley or court leads. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building; provided, that in determining whether two-thirds of the buildings on both sides of such street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered and provided further that the word "block" as used in this section shall not be held to mean a square but shall be held to embrace only that part of the street in question which lies between the two nearest intersecting streets.

930. **Hospital or Home frontage consents.)** It shall be unlawful for any person, firm, association or corporation to build, construct, maintain, conduct or manage a hospital, or a home, as defined in chapter XXXIX of this ordinance, in any block in which two-thirds of the buildings fronting on both sides of the street or streets on or along which the proposed hospital or home may face are devoted exclusively to residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on or along which said building faces consent in writing to the building, construction or maintaining, managing or conducting of any such hospital or home in such block; provided, however, that no new frontage consents shall be required if such hospital or home has heretofore been licensed by the city of Chicago as a hospital, home or nursery at the present location. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or construction of any such hospital or home, and before a license shall be issued for the maintaining, conducting or managing of any such hospital or home.

931. **Undertaking establishment frontage consents.)** It shall be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in chapter XXXIX of this ordinance, that receives in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any boulevard or pleasure driveway, without the written consent of a majority of the property owners according to the frontage on both sides of such boulevard or pleasure driveway in the block in which such morgue or place of business is located; it shall also be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in chapter XXXIX of this ordinance, that receives, in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any street in any block in which two-thirds of the buildins on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided that nothing herein contained shall ap;ply to such location in the case of any person licensed as an undertaker and authorized to carry on such business at any such location at the time of the passage of this ordinance nor to any block in any street on which street cars are operated. Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

932. **Ice Plant Frontage Consents.)** It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice-making house or cooling plant, or any buildings used for the storage of ice, in any block in which two-thirds of the buildings fronting on both sides of the street on which the proposed plant shall be located are devoted exclusively to residence purposes, unless the owners of the majority of the frontage in said block on both sides of the street on which said plant is located shall consent in writing to the location, establishment, conducting or maintenance of such plant in such block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Buildings before a permit shall be granted for the building or construction of any such ice-making house or cooling plant. Any person, firm or corporation violating any of the provisions of the section, or refusing, failing or neglecting to comply with any of the said provisions, shall be fined not less than five dollars nor more than one hundred dollars for each offense, and a separate offense shall be regarded as having been committed for each day during which such violation shall continue.

933. **Frontage consents—general requirements.)** Whenever frontage consents are required, for the construction of a building or for any occupation for which a building is about to be constructed or altered, under any section of this ordinance or under any other ordinance of the city, such frontage consents shall be presented to the commissioner of buildings before the issuance of a permit for the erection or alteration of a building for such purpose. Unless otherwise specified the provisions of this chapter in such case shall apply as to the definition of the word "block," whenever such word is used in provisions requiring frontage consents.

ARTICLE XXV.

Fire Limits.

934. **Fire limits and provisional fire limits.)** (a) The fire limits of the city of Chicago within which wooden buildings shall not be erected, shall be and they are hereby defined as follows: all that part of the city of Chicago bounded by the following limits: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, then south along the east line of said right of way of the Chicago and North Western Railway Company to a line 125 feet north of the north line of Foster avenue, thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore channel, thence southeasterly along the center line of said North Shore channel to the center line of the North branch of the Chicago river, thence northwesterly and westerly along the center line of said North branch of the Chicago river to a line 125 feet west of the west line of north Kedzie avenue, thence south along said line 125 feet west of the west line of north Kedzie avenue, to a line 125 feet south of the south line of Irving Park boulevard, thence east along said line 125 feet south of the south line of Irving Park boulevard to the center line of the north branch of the Chicago river, thence northerly along the center line of

the north branch of the Chicago river to the center line of Berteau avenue, thence east along the center line of Berteau avenue to a line 125 feet west of the west line of north Western avenue, thence south along said line 125 feet west of the west line of north Western avenue to the center line of Addison street, thence east along the center line of Addison street to the center line of north Western avenue, thence south along the center line of north Western avenue to the center line of Belmont avenue, thence east along the center line of Belmont avenue to the center line of Southport avenue, thence south along the center line of Southport avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of the North Branch of the Chicago river, thence northwesterly along the center line of the North Branch of the Chicago river to a line 125 feet north of the north line of Belmont avenue thence west along said line 125 feet north of the north line of Belmont avenue to a line 125 feet west of the west line of north Kostner avenue, thence south along said line 125 feet west of the west line of north Kostner avenue to a line 125 feet north of the north line of Diversey avenue, thence west along said line 125 feet north of the north line of Diversey avenue, to a line 125 feet west of the west line of north Cicero avenue, thence south along said line 125 feet west of the west line of north Cicero avenue to the center line of west Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of north Laramie avenue, thence south along the center line of north Laramie avenue to a line 125 feet northeasterly of the northeasterly line of west Grand avenue, thence northwesterly along said line 125 feet northeasterly of the northeasterly line of west Grand avenue to the center line of Harlem avenue, thence south along the center line of Harlem avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to a line 125 feet south of the south line of Armitage avenue, thence east along said line 125 feet south of the south line of Armitage avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to the southerly line of the right of way of the Chicago, Milwaukee and St. Paul Railway Company, thence northwesterly and westerly along the southerly line of the said right of way of the Chicago, Milwaukee & St. Paul Railway Company to the center line of Narragansett avenue, thence south along the center line of Narragansett avenue to the center line of west North avenue, thence east along the center line of west North avenue to the center line of north Austin avenue, thence south along the center line of north Austin avenue to the center line of west Roosevelt road, thence east along the center line of west Roosevelt road to the center line of south Kenton avenue produced north, thence south along the center line of south Kenton avenue produced north and the center line of south Kenton avenue to the center line of west 39th street produced west, thence east along the center line of west 39th street produced west to the center line of the Illinois and Michigan canal, thence northeasterly along the center line of the Illinois and Michigan canal to the center line of south Western avenue boulevard, thence south along the center line of south Western avenue boulevard to the center line of west 39th street, thence east along the center line of west 39th street to the center line of south Robey street, thence south along the center line of south Robey street to the center line of west 43rd street, thence east along the center line of west 43rd street to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the center line of west 41st street, thence east along the center line of west 41st street to the center line of south Ashland avenue, thence north along the center line of south Ashland avenue to the center line of west 40th street, thence east along the center line of west 40th street to a line 125 feet east of the east line of south Ashland avenue thence south along said line 125 feet east of the east line of south Ashland avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of south Ashland avenue, thence south along the center line of south Ashland avenue to the center line of west 47th street, thence east along the center line of west 47th street to a line 125 feet west of the west line of south Halsted street, thence south along said line 125 feet west of the west line of south Halsted street to the center line of west 51st street, thence west along the center line of west 51st street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to a line 125 feet north of the north line of west 63rd street, thence west along said line 125 feet north of the north line of west 63rd street to the center line of south Western avenue, thence north along the center line of south Western avenue and south Western avenue boulevard to the center line of west 45th street, thence west along the center line of west 45th street and west 45th street produced west to the center line of south Cicero avenue, thence south along the center line of south Circero avenue to the center line of west 51st street, thence west along the center line of west 51st street to the southerly line of the right of way of the Chicago and Alton Railroad and thence southwesterly along said southerly line of the right of way of the Chicago and Alton Railroad to the center line of south Harlem avenue, thence south along the center line of south Harlem avenue to the center line of west 59th street, thence east along the center line of west 59th street to the center line of south Narragansett avenue, thence south along the center line of south Narragansett avenue and Narragansett avenue produced south to the center line of west 65th street produced west, thence east along the center line of west 65th street produced west and west 65th street to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 69th street produced west, thence east along the center line of west 69th street produced west and west 69th street to the center line of south Western avenue, thence north along the center line of south Western avenue to a line 125 feet south of the south line of west 63rd street, thence east along the said line 125 feet south of the south line of west 63rd street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to the center line of west 75th street, thence west along the center line of west 75th street to a line 125 feet east of the east line of south Ashland avenue, thence north along said line 125 feet east of the east line of south Ashland avenue to the center line of west 71st street, thence west along the center line of west 71st street to a line 125 feet west of the west line of South Ashland avenue, thence south along said line 125 feet west of the west line of south Ashland avenue to the center line of west 75th street, thence west along the center line of west 75th street and west 75th street produced to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 87th street, thence east along the center line of west 87th street to the center line of south Western avenue, thence south along the center

line of south Western avenue to the center line of west 99th street, thence west along the center line of west 99th street to the center line of south California avenue, thence south along the center line of south California avenue to the center line of west 115th street, thence east along the center line of west 115th street to the center line of south Western avenue, thence south along the center line of south Western avenue to the center line of west 119th street, thence east along the center line of west 119th street to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the center line of west 103rd street, thence east along the center line of west 103rd street to the center line of south Halsted street, thence north along the center line of south Halsted street to a line 125 feet south of the south line of west 95th street, thence east along said line 125 feet south of the south line of west 95th street to the center line of Eggleston avenue, thence north along the center line of Eggleston avenue and Eggleston avenue produced north to a line 125 feet south of the south line of west 83rd street, thence east along said line 125 feet south of the south line of west 83rd street to a line 125 feet east of the east line of Stewart avenue, thence south along said line 125 feet east of the east line of Stewart avenue and Stewart avenue produced south to a line 125 feet north of the north line of west 95th street, thence east along said line 125 feet north of the north line of west 95th street to a line 125 feet west of the west line of south State street, thence south along said line 125 feet west of the west line of south State street to a line 125 feet south of the south line of west 99th street, thence east along a line 125 feet south of the south line of west and east 99th street to a line 125 feet west of the west line of south Michigan avenue, thence south along said line 125 feet west of the west line of south Michigan avenue to a line 125 feet north of the north line of east 119th street, thence west along a line 125 feet north of the north line of east and west 119th street to a line 125 feet west of the west line of south Morgan street, thence south along said line 125 feet west of the west line of south Morgan street to a line 125 feet south of the south line of west 119th street, thence east along a line 125 feet south of the south line of west and east 119th street to a line 125 feet east of the east line of south Michigan avenue, thence north along said line 125 feet east of the east line of south Michigan avenue to a line 125 feet south of the south line of east 99th street, thence east along said line 125 feet south of the south line of east 99th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 115th street, thence east along the center line of east 115th street to the northeasterly line of the right of way of the Michigan Central Railroad Company, thence south and southeasterly along said northeasterly line of the right of way of the Michigan Central Railroad Company to the center line of east 127th street, thence east along the center line of east 127th street to the shore line of Lake Calumet, thence northwesterly and northeasterly along the shore line of said Lake Calumet to a line 125 feet east of the east line of Stony Island avenue, thence north along said line 125 feet east of the east line of Stony Island avenue to a line 125 feet north of the north line of east 95th street, thence west along said line 125 feet north of the north line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the center line of east 83rd street, thence east along the center line of east 83rd street to the east line of the right of way of the New York, Chicago and St. Louis Railroad, thence south and southeast along said east line of the right of way of the New York, Chicago and St. Louis Railroad to the center line of east 87th street, thence east along the center line of east 87th street to the center line of Jeffery avenue, thence north along the center line of Jeffery avenue to the southwest line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeast along said southwest line of the right of way of the Lake Shore and Michigan Southern Railway to a line 125 feet west of the west line of Yates avenue, thence north along said line 125 feet west of the west line of Yates avenue to a line 125 feet south of the south line of east 83rd street, thence east along said line 125 feet south of the south line of east 83rd street to the center line of Yates avenue, thence north along the center line of Yates avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the center line of Brandon avenue, thence south along the center line of Brandon avenue to the center line of east 83rd street, thence east along the center line of east 83rd street to the center line of Burley avenue, thence south along the center line of Burley avenue, to the center line of east 89th street, thence west along the center line of east 89th street to a line 125 feet west of the west line of Manistee avenue, thence south along said line 125 feet west of the west line of Manistee avenue to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeasterly along said northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway to the easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company, thence southwesterly along said easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company to the center line of east 106th street, thence east along the south line of east 106th street to a line 200 feet east of the east bank of the Calumet river, thence northerly along said line 200 feet east of the east bank of the Calumet river to the center line of east 95th street, thence east along the center line of east 95th street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

All that part of the City of Chicago bounded by the following limits is hereby included within the fire limits of the City of Chicago: Commencing at the intersection of the center line of West 95th street and South Ashland avenue thence west along the center line of West 95th street to the right of way of the suburban branch of the Chicago, Rock Island and Pacific Railroad Company, thence north along the right of way of the suburban branch of the Chicago, Rock Island and Pacific Railroad Company to the center line of West 90th street, thence east along the center line of East 90th street to its intersection with the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the intersection of the center line of West 95th street or the place of beginning.

(b) Also beginning at the intersection of the center line of Addison street and the center line of the North Branch of the Chicago river, thence west along the center line of Addison street to the center line of north Whipple street, thence south along the center line of north Whipple street to the center line of Elston avenue, thence southeasterly along the center line of Elston avenue to the center line of Roscoe street,

thence east along the center line of Roscoe street to the center line of the North Branch of th Chicago River, thence north along the center line of the North Branch of the Chicago river to the place of the beginning.

Also beginning at the intersection of the east line of the right of way of the Chicago & Northwestern Railway Company and a line 125 feet north of the north line of Foster avenue; thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore Channel of the Sanitary District Canal; thence northwesterly along the center line of said North Shore Channel to the center line of Devon avenue; thence east along the center line of Devon avenue to the center line of North Kedzie avenue produced north; thence North along the center line of North Kedzie avenue produced north to the center line of Howard street produced west; then east along said center line of Howard street produced west and Howard street to the east line of the right of way of the Chicago & Northwestern Railway; thence southeasterly and southerly along the said east line of the right of way of the Chicago & Northwestern Railway to the place of beginning.

—Amendment of January 23, 1924.

Also beginning at the intersection of West 69th street and South California avenue; thence south along the center line of South California avenue to the center line of West 75th street; thence east along the center line of West 75th street to the center line of Irving avenue; thence north along the center line of Irving avenue to the center line of West 69th street; thence west along the center line of West 69th street to the place of beginning.

—Amendment of March 12, 1924.

(b 1) Also, beginning at the intersection of the center line of North Harlem avenue and Addison street, thence east along Addison street to the center line of North Tripp avenue; thence north along the center line of North Tripp avenue to the center line of Montrose avenue; thence east along the center line of Montrose avenue to the center line of North Crawford avenue; thence north along the center line of North Crawford avenue to the North Branch of the Chicago River; thence northwesterly along the North Branch of the Chicago River to the center line of Bryn Mawr avenue; thence west along the center line of Bryn Mawr avenue to the center line of North Austin avenue; thence south along the center line of North Austin avenue to the center line of Irving Park boulevard; thence west along the center line of Irving Park Boulevard to the center line of North Harlem avenue; thence south along the center line of North Harlem avenue to the place of beginning.

—Amendment of May 7, 1924, *and further amended (June* 18, 1924) *to take effect on January* 1, 1925; *further amended to take effect July* 1, 1925, *and further amended to take effect January* 1, 1926.

Also commencing at the intersection of the center line of East 67th street with the center line of South Park avenue, thence west along the center line of East 67th street to its intersection with the center line of South State street, thence south along the center line of South State street to its intersection with the center line of East 75th street, thence east along the center line of East 75th street to its intersection with the center line of South Park avenue, thence north along the center line of South Park avenue to the place of beginning.

Also commencing at the intersection of the center line of West 83rd street and the easterly line of the right of way of the Chicago, St. Louis and Pittsburgh Railroad Company; thence southeasterly along said easterly line to its intersection with the center line of West 90th street; thence east along the center line of West 90th street to its intersection with the center line of South Winchester avenue; thence northerly along the center line of South Winchester avenue to its intersection with the center line of West 83rd street, and thence west along the center line of West 83rd street to the place of beginning.

Also beginning at the intersection of East 87th street and Stony Island avenue; thence south along the center line of Stony Island avenue to the center line of East 91st street; thence east along the center line of East 91st street to the center line of Colfax avenue; thence north along the center line of Colfax avenue to the right of way of the Pennsylvania Railroad; thence northwesterly along the right of way of the Pennsylvania Railroad to the center line of East 87th street; thence west along the center line of East 87th street to the place of beginning.

Beginning at the intersection of a line 125 feet south of the south line of West 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of West 95th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the place of beginning.

Also beginning at the intersection of East 106th street and State Line road; thence west along the center line of East 106th street to the right of way of the South Chicago and Southern Railroad; thence south along the right of way of the South Chicago and Southern Railroad to the center line of East 108th street; thence west along the center line of East 108th street to the center line of Avenue G; thence south along the center line of Avenue G to the center line of East 110th street; thence west along the center line of East 110th street to the center line of Avenue O; thence south along the center line of Avenue O to the center line of East 114th street; thence east along the center line of East 114th street to the right of way of the South Chicago and Southern Railroad; thence north along the right of way of the South Chicago and Southern Railroad to the center line of East 112th street; thence east along the center line of East 112th street to the Illinois and Indiana State line; thence north along the Illinois and Indiana State line to the place of beginning.

Passed (5 ordinances) Dec. 23, 1924.

Also, beginning at the intersection of the center line of North Harlem avenue and Addison street thence east along Addison street to a line 125 feet east of the east line of North Cicero avenue; thence south along said line 125 feet east of the east line of North Cicero avenue to a line 125 feet north of the north line of Diversey avenue; thence west along said line 125 feet north of the north line of Diversey avenue to a line 125 feet west of the west line of North Cicero avenue; thence south along the said line 125 feet west of the west line of North Cicero avenue to a line 125 feet south of the south line of West Diversey avenue; thence west along the said line 125 feet south of the south line of West Diversey avenue to the center line of North Harlem avenue; thence north along the center line of North Harlem avenue to the place of beginning.

Passed February 27, 1925.

Also beginning at the intersection of West Garfield boulevard and South Racine avenue; thence west along the center line of West Garfield boulevard to the center line of South Wood street; thence south along the center line of South Wood street to the center line of West 66th street; thence east along the center line of West 66th street to the center line of Loomis boulevard; thence north along the center line of Loomis boulevard to the center line of West 63rd street; thence east along the center line of West 63rd street to the center line of South Racine avenue; thence north along center line of South Racine avenue to the place of beginning.

Passed, May 6, 1925.

Also beginning at the intersection of West 49th street and Loomis street; thence west along the center line of West 49th street to the center line of South Western avenue;

thence south along the center line of South Western avenue to a line 125 feet north of the north line of West 63rd street; thence east along said line 125 feet north of the north line of West 63rd street to the center line of South Wood street; thence north along the center line of South Wood street to the center line of West Garfield boulevard; thence east along the center line of West Garfield boulevard to the center line of Loomis street; thence north along the center line of Loomis street to the place of beginning.

Also beginning at the intersection of a line 125 feet south of the south line of West 63rd street, and the center line of South Wood street; thence west along said line 125 feet south of the south line of West 63rd street to the center line of South Western avenue; thence south along the center line of South Western avenue to the center line of West 69th street; thence east along the center line of West 69th street to the center line of South Wood street; thence north along the center line of South Wood street to the place of beginning.

Passed (2 ordinances), May 13, 1925.

Also beginning at the intersection of West 59th street and South Narragansett avenue; thence west along the center line of West 59th street to the center line of South Harlem avenue; thence south along the center line of South Harlem avenue to the center line of West 65th street; thence east along the center line of West 65th street to the center line of South Narragansett avenue; thence north along the center line of South Narragansett avenue to the place of beginning.

Passed, June 10, 1925.

(c) Excepting the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Foster avenue and the center line of north Leavitt street, thence west along said line 125 feet south of the south line of Foster avenue to a line 125 feet east of the east line of north Western avenue, thence south along said line 125 feet east of the east line of north Western avenue to a line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue to a line 125 feet north of the north line of Lawrence avenue, thence east along said line 125 feet north of the north line of Lawrence avenue to the center line of north Leavitt street, thence north along the center line of north Leavitt street to the place of beginning.

(d) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Belmont avenue and the center line of north Kedzie avenue, thence west along said line 125 feet south of the south line of Belmont avenue to the center line of north Crawford avenue, thence south along the center line of north Crawford avenue to the center line of north Fullerton avenue, thence east along the center line of Fullerton avenue to the center line of north Central Park avenue, thence north along the center line of north Central Park avenue to the center line of Diversey avenue, thence east along the center line of Diversey avenue to the center line of north Kedzie avenue, thence north along the center line of north Kedzie avenue to the place of beginning.

(e) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of te south line of west Division street and the center line of north Laramie avenue, thence west along said line 125 feet south of the south line of west Division street to the center line of north Central avenue, thence south along the center line of north Central avenue to the center line of west Chicago avenue, thence east along the center line of west Chicago avenue to the center line of north Laramie avenue, thence north along the center line of north Laramie avenue to the place of beginning.

(f) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 43rd street and a line 125 feet west of south State street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of Wentworth avenue, thence south along said line 125 feet east of the east line of Wentworth avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of south State street, thence north along said line 125 feet west of the west line of south State street to the place of beginning.

(g) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 40th street and the center line of Normal avenue, thence west along the center line of west 40th street to the center line of Wallace street, thence south along the center line of Wallace street to the center line of west 43rd street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of south Halsted street, thence south along said line 125 feet east of the east line of south Halsted street to the center line of west 51st street, thence east along the center line of west 51st street to the center line of south Union avenue, thence south along the center line of south Union avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of Wentworth avenue, thence north along said line 125 feet west of the west line of Wentworth avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of Normal avenue, thence north along the center line of Normal avenue to the place of beginning.

(h) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 52nd street and the center line of south Peoria street, thence west along the center line of west 52nd street to the center line of south Morgan street, thence south along the center line of south Morgan street to the center line of west 53rd street, thence east along the center line of west 53rd street to the center line of south Peoria street, thence north along the center line of south Peoria street to the place of beginning.

(i) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 83rd street and the center line of south Winchester avenue, thence west along said line 125 feet south of the south line of west 83rd street to the east line of the right of way of the Pittsburgh, Chicago, Cincinnati and St. Louis Railway, thence southeasterly along the said east line of the right of way to the Pittsburgh, Chicago, Cincinnati and St. Louis Railway to the center line of west 87th street, thence east along the center line of west 87th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company in south Hermitage avenue, thence northeasterly in south Hermitage avenue along said northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company to the center line of south Winchester avenue, thence northwesterly and north along the center line of south Winchester avenue to the place of beginning.

(j) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 91st street and a

line 125 feet west of the west line of south Ashland avenue, thence west along the center line of west 91st street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the place of beginning.

(k) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of west 95th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the place of beginning.

(l) Excepting also the following territory, which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, thence south along the east line of the right of way of the Chicago and North Western Railway Company to the center line of Devon avenue, thence east along the center line of Devon avenue to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(m) Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of east 67th street, thence west along the center line of east 67th street to the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue to the center line of east 63rd street , thence west along the center line of East 63rd street to the center line of South Park avenue, thence south along the center line of South Park avenue to the center line of east Marquette road, thence west along the center line of east Marquette road to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company, thence northwesterly along the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company to the center line of south State street, thence south along the center line of south State street to the center line of east 75th street, thence east along the center line of east 75th street to the center line of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the east line of the right of way of the Illinois Central Railroad, thence north along the east line of the right of way of the Illinois Central Railroad to the center line of east 79th street, thence east along the center line of east 79th street to the center line of Stony Island avenue, thence south along the center line of Stony Island avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(n) Excepting also the following territory which shall be known as a provisional fire limit district; beginning at the intersection of the center line of east 87th street and a line 125 feet east of the east line of the right of way of the Illinois Central Railroad, thence west along the center line of east 87th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 95th street, thence east along the center line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the place of beginning.

Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of a line 125 feet south of the south line of West 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of West 95th street to the center line of Beverly avenue, thence in a southeasterly direction along the center line of Beverly avenue to the center line of West 99th street, thence east along the center line of West 99th street, to the center line of Vincennes avenue, thence in a northeasterly direction along the center line of Vincennes avenue to the place of beginning.

The territory bounded on the south by the north side of West 95th street; on the north by the south side of West 90th street; on the east by the west side of South State street; and on the west by the east side of Wentworth avenue, shall be and the same is hereby excluded from the fire limits of the City of Chicago; provided, however, that it shall be unlawful to erect within said territory any buildings costing less than twenty-one hundred ($2,100.00) dollars, except garages on the rear of the lots of said territory.

(o) Within the provisional fire limits above described it shall be lawful to erect a frame or wooden building to be used for residence or mercantile purposes upon presenting a petition to the commissioner of buildings, together with a plat, plans and specifications showing the space where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon both sides of the streets surrounding the square in which the proposed building is to be erected.

(p) No frame or wooden residence or mercantile building shall be erected within the provisional fire limits exceeding 40 feet in height.

935. **Maps showing fire limits.)** As soon as practicable after the passage of this ordinance the superintendent of maps shall prepare, or cause to be prepared, three maps of the city of Chicago drawn to a scale sufficiently large to meet the requirements of this section, on which shall be accurately indicated the area and boundaries of the fire limits and of the provisional fire limits, as defined in the preceding section. Such maps shall be alike in all respects. One of said maps, when found to be accurate and in strict compliance with the foregoing section with respect to areas and boundaries, to the satisfaction of the mayor, shall be marked as approved by the mayor, and shall be placed in the custody of the city clerk, and the same shall be kept on file in the office of said clerk and regarded as an exhibit the same as if were a part of this ordinance. Another of said maps shall be turned over to the commissioner of buildings, whose duty it shall be to preserve the same, and to supervise the correction of all three of said maps from time to time as hereinafter provided. The third of said maps shall be retained by the superintendent of maps. Such maps may be altered, corrected, revised or replaced from time to time as the city council may direct.

After the passage of this ordinance the city council, in future ordinances making

changes in the fire limits or provisional fire limits of the city, may make reference to the said map on file in the city clerk's office, and may alter, correct or revise the fire limits or the provisional fire limits of the city by reference thereto or by stating what change shall be made to the fire limits or provisional fire limits as shown on said map; such references to said map, when clear and unambiguous, shall be deemed authoritative and shall be regarded as describing the areas and boundaries of the changed portion of the said fire limits or provisional fire limits regardless of whether the language of such ordinance correctly amends the preceding section or not; and such alterations, corrections and revisions, when duly passed, approved and published, shall be deemed amendments of the preceding section and shall be construed as altering, correcting and revising the fire limits as set forth in the preceding section.

It shall be the duty of the superintendent of maps to correct the said maps under the supervision of the commissioner of buildings so as to accurately portray the fire limits and provisional fire limits up to date whenever a change is authorized therein as by this section provided, and to replace the said maps with new maps when the city council so directs.

ARTICLE XXVI.

Regulations Concerning Places of Amusement.

936. **No amusement license to issue without certificate from city officials.)** No license shall be issued to any person, firm or corporation to produce, present, conduct, operate or offer for gain or profit, any theatricals, shows or amusements until the commissioner of buildings, the commissioner of health, the chief fire prevention Engineer and the commissioner of gas and electricity shall have certified in writing that the room or place where it is proposed to produce, present, conduct, operate or offer such theatricals, shows or amusements complies in every respect with the ordinances of the city of Chicago relating to their respective departments.

937. **Lighting—building kept lighted during performance.)** Every portion of any building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain or profit, devoted to the use or accomodation of the public, and all outlets therefrom leading to the street, including all open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and shall remain lighted until the entire audience has left the premises. It shall be the duty of the chief fire prevention Engineer to enforce the provisions of this section.

938. **Independent lighting system for exits.)** All stairways and corridors in every building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be supplied with a supplemental lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building or structure and shall be in operation during the entire period that such building or structure is open to the public and until the entire audience has left the building.

The word "EXIT" shall appear in letters at least six inches high over the opening of every means of egress from such building or structure, and a red light shall be kept burning over such sign.

It shall be the duty of the commissioner of gas and electricity to enforce the provisions of this section relative to the installation of the lighting provisions contained therein; and it shall be the duty of the chief of fire prevention and public safety to see that the lights are kept lighted as required by this section.

939. **Gas calcium lights prohibited—arc lights.)** The use of gas calcium lights in any building in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain is hereby prohibited.

All arc lights used on the stage shall be subject to the approval of the commissioner of gas and electricity.

940. **Exit doors or gates not to be locked —obstructions prohibited.)** No exit door or gate in any place in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be locked or fastened in any manner during the entire time that such place of amusement is open to the public.

All aisles, passageways, corridors and exits of all such places of amusement shall be kept free from camp stools, chairs, sofas, draperies and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance.

941. **Diagram of exits and seats.)** It shall be the duty of the owner, lessee or manager of any theater having a seating capacity in excess of three hundred persons to cause to be printed on all programs furnished for any performance, on the page opposite to that upon which the cast is printed, a diagram showing conspicuously the place of every exit from such building. A diagram of the floor plan, showing the location of every seat on each floor, and also the exits leading from each floor, drawn to a scale of one-eighth of an inch to the foot, shall be posted in a conspicuous place at or near the box office of any such theater, so as to be easily seen by the public. It shall be the duty of the chief fire prevention Engineer to enforce the provisions of this section.

942. **Penalty.)** Any person, firm or corporation violating any of the provisions of this article shall be fined not more than two hundred dollars for each offense, and each and every day upon which any such person, firm or corporation shall give, conduct, produce, present, offer or operate any such entertainment contrary to or in violation of any of the provisions of this article shall constitute a separate and distinct offense.

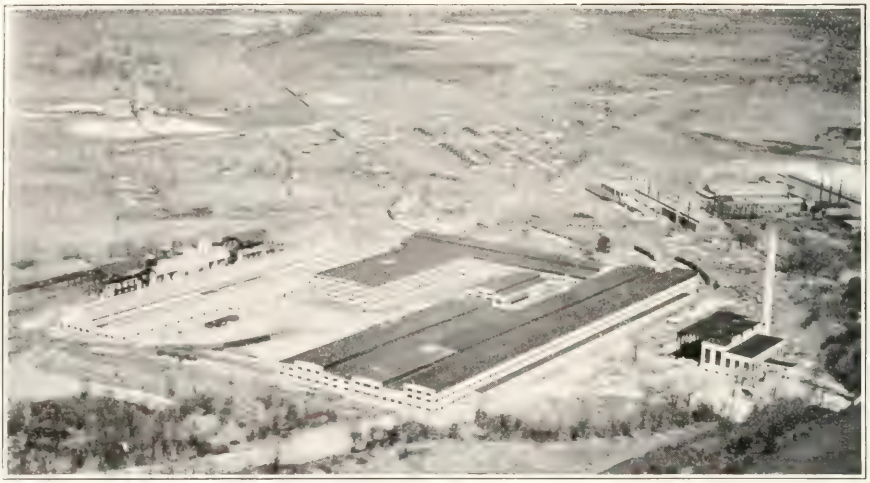
ARTICLE XXVII.

NUISANCE AND PENALTY.

943. **Nuisance.)** (a) Every building or structure constructed or maintained in violation of this chapter, or which is in an unsanitary condition, or in an unsafe or dangerous condition or which in any manner endangers the health or safety of any person or persons, is hereby declared to be a public nuisance.

(b) Every building or part thereof which is in an unsanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water, or by reason of the presence of sewer gas, or by reason of any portion of a building being infected with disease or being unfit for human habitation, or which, by reason of any other unsanitary condition, is a source of sickness, or which endangers the public health, is hereby declared to be a public nuisance.

944. **Theatres Located Above the First Floor Declared a Nuisance — Exceptions — Regulations.)** It shall be and it is hereby declared to be a nuisance to conduct a public theatre in a room located on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordi-



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nances of the City of Chicago with reference to fireproof construction in force at the time such building was built. All such public theatres now being conducted in rooms on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, with a seating capacity of more than three hundred, shall be and they are hereby declared to be nuisances; and it shall be unlawful to continue to use such rooms for public theatrical purposes whether the same are equipped with a stage and scenery or are used for moving picture shows only.

The provisions of the foregoing paragraph shall not apply where the theatre is altered so as to bring the main audience room on the first floor level and slow-burning construction is used in the reconstruction work and in making such alterations and all requirements of the ordinances of the City applying to Class IVb are complied with, nor shall said provisions apply where the following conditions are fully complied with:

(a) The building shall be used for theatre purposes only.

(b) The seating capacity shall not exceed the seating capacity existing therein on July 22 1912.

(c) Metal scenery only shall be used; provided, however, one proscenium drop, one back drop and three borders may be used provided they are of asbestos cloth subject to the approval of the Chief Fire Prevention Engineer.

(d) All seats shall be at least eighteen inches wide and spaced thirty-two inches from back to back.

(e) There shall be no boxes, stalls or loges.

(f) No stove or furnace heating shall be allowed.

(g) All lighting shall be by electricity; provided, however, that gas may be used in connection with exit lights.

(h) At least sixty inches of exit space shall be provided for every one hundred seats.

(i) The stage shall not be more than twenty-two feet from front to rear.

(j) The audience room shall be surrounded by brick walls.

(k) In all cases where dressing rooms are placed back of the stage the brick wall shall extend between the stage and such dressing rooms, but the stage wall may contain a door leading to such dressing room located behind said wall.

(l) All dressing rooms shall have incombustible partitions and all existing wooden partitions, wherever located, shall be removed.

(m) There shall be an open space on at least three sides of the building containing such theatre, except as otherwise herein provided, which space shall be open from the floor level of the auditorium to the sky.

(n) One of such open spaces must be a public street and the others public or private alleys or open spaces leading directly to a street or public or private alley, and in all cases where such open space is private ground, it must be at least five feet wide where the seating capacity does not exceed six hundred, and six inches additional width must be provided for each one hundred seats installed in such theatre in excess of six hundred; provided, however, that in all cases where a sprinkler system is installed over the stage, together with an approved power pump and pressure tank subject to the approval of the Chief Fire Prevention Engineer, it shall be sufficient if there are open spaces as above required on two sides of the building in which such theatre is located.

(o) Wherever the side of an audience room adjoins an open space, as hereinabove required, which open space is on private ground or is a private or public alley, there shall be a five-foot open iron platform extending the entire length of the audience room, with an open iron stairway leading to the ground from said platform at each end thereof, and in all such cases there shall be a stairway fire escape leading from the gallery of the theatre, if there is a gallery, to such platform.

(p) Where the only open space adjoining the side of the audience room is a public street, there shall be a five-foot stairway, enclosed by walls of incombustible material, leading from the middle of the audience room on the side contiguous to such street to the first floor, at the bottom of which stairway there shall be an exit opening directly to the street, and in such cases there shall be a three-foot stairway leading from the gallery, if there is a gallery, to the main floor of the auditorium, the bottom of which shall be within ten feet of the stairway leading from such main floor to the ground floor.

(q) There shall be an exit at least five feet wide on each side of the stage, which exit shall lead through a passageway constructed entirely of incombustible material to a stairway which shall be completely enclosed with incombustible material. Said stairway shall lead to the ground level and communicate through a passageway of incombustible material directly with a public street or alley or a private alley which leads directly to a public street or alley.

(r) An exit shall be provided on each side of the balcony or gallery at the end nearest the stage by means of a stairway of incombustible material leading to the main floor of the audience room.

(s) The exits at the front of the theatre shall communicate with stairways of incombustible material leading directly to the ground level and either opening directly out upon the street or communicating with the street through fireproof passageways, and in no case shall any stairway leading from the main audience floor to the ground level communicate or connect with any other such stairway.

(t) All doors leading through the proscenium wall or from the stage to the dressing rooms shall be of incombustible material.

(u) All alterations made in buildings containing such theatres shall be of slow-burning construction, except as herein otherwise provided.

945. **Penalty.)** Any person, firm or corporation that violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, where no other penalty is provided, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense and every such person, firm or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designing, drawing plans for, or having charge of such building, or who who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

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Special Rulings of the Building Department of the City of Chicago

These rulings are not a part of the Code of the City of Chicago; but are requirements of the Building Department.

BRACING OF TRUSSES, COLUMNS, WALLS, ETC., IN STEEL SKELETON CONSTRUCTION.

I.

In regard to Section 781 of the Revised Building Ordinances, the Commissioner has ruled that the following interpretation shall be placed upon the section concerning bracing:

(a) All skeleton buildings, trusses, and structures shall be securely braced during erection by guys, cables or such other temporary supports as may be necessary to provide for stresses due to erection.

(b) Special wind bracing shall be provided in steel skeleton buildings over one hundred (100) feet in height or higher than twice the least width.

(c) For permanent construction bracing shall be so designed that the **skeleton will be self-supporting and safe against lateral and buckling or crippling forces before any of the inclosing walls or roofs are built in place.**

(d) In cases where wind forces are nominal and to prevent buckling or crippling, the minimum amount of bracing required shall be ¾″ rod for steel tension members or equivalent in other material. Compression members shall be limited in length to one hundred and fifty (150) times the least radius of gyration or otherwise as specified in the Ordinances.

(e) Trusses shall be properly anchored to the walls at the point of bearing in such a way as not to strain the masonry on account of the temperature stresses in the truss.

(f) In general, all eccentric loading on the foundations shall be avoided and where not possible to do so, proper bracing between opposite walls shall be provided, sufficient to offset the bending moment due to eccentricity.

NOTES ON REINFORCED CONCRETE DESIGN.

II

(a) In regard to Section 763, as applying to a combination of tile and concrete construction, the Commissioner has ruled that the width of flange of the concrete joists may be assumed as the full distance c. to c. of ribs but not exceeding eight (8) times the thickness of the concrete on top of tile fillers, plus the average width of rib.

(b) In computing the shear at supports, the average width of the concrete rib plus the thickness of the tile on one side of the rib may be figured as the effective width of joist, provided that joints in tile are properly staggered.

(c) When steel or plaster fillers are used between concrete joists, the width of flange shall be limited to three-fourths (¾) of the distance center to center of ribs as per Section 763.

In regard to Section 760 (e)

(a) When compression is applied to a surface of concrete of at least twice the loaded area, a stress of thirty (30) per cent of the ultimate may be allowed, and

(b) In continuous beams and girders the compressive stress in extreme fibre at the support may be fifteen (15) per cent greater than at the center of span.

In regard to Section 762 (1)

The total amount of steel required for square slabs with two-way reinforcement may be reduced twenty (20) per cent by gradually increasing the rod spacing from the third point to the edge of the slab.

THE DESIGN OF FLAT SLABS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RULING.

III

Definitions.

(1) Flat slabs as understood by this ruling are reinforced concrete slabs, supported directly on reinforced columns with or without plates or capitals at the top, the whole construction being hingeless and monolithic without any visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor.

(2) The column capital shall be defined as the gradual flaring out of the top of the column without any marked offset.

(3) The drop panel shall be defined as a square or rectangular depression around the column capital extending below the slab adjacent to it.

(4) The panel length shall be defined as the distance center to center of columns of the side of a square panel, or the average distance center to center of columns of the long and short sides of a rectangular panel.

Columns.

(5) The least dimension of any concrete column shall be not less than one-twelfth (1/12) the panel length, nor one-twelfth (1/12) the clear height of the column.

Slab Thickness.

(6) The minimum total thickness of the slab in inches shall be determined by the formula: $t = \frac{W^{1/2}}{44}$ = square root of W divided by forty-four, where t = total thickness of slab in inches, W = total live and dead load in pounds on the panel, measured center to center of columns.

(7) In no case shall the thickness be less than one thirty-second of the panel length (L/32) for floors, nor one-fortieth of the panel length (L/40) for roofs, (L being the distance center to center of columns).

(8) In no case shall the thickness of slab be less than six inches (6″) for floors or roofs.

Column Capital.

(9) When used the diameter of the column capital shall be measured where its vertical thickness is at least one and one-

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half inches (1½"), and shall be at least two hundred and twenty-five thousandths (.225) of the panel length.

The slope of the column capital shall nowhere make an angle with the vertical of more than forty-five degrees. Special attention shall be given to the design of the column capital in considering eccentric loads, and the effect of wind upon the structure.

Drop Panel.

(10) When used, the drop panel shall be square or circular for square panels and rectangular or elliptical for oblong panels.

(11) The length of the drop shall not be less than one-third of the panel length (L/3) if square, and not less than one-third of the long or short side of the panel respectively, if rectangular.

(12) The depth of the drop panel shall be determined by computing it as a beam, using the negative moment over the column capital specified elsewhere in this ruling.

(13) In no case, however, shall the dimensions of the drop panel be less than required for punching shear along its perimeter, using the allowable unit shearing stresses specified below.

Shearing Stresses.

(14) The allowable unit punching shear on the perimeter of the column capital shall be three-fiftieths (3/50) of the ultimate compressive strength of the concrete as given in section 759 of the building ordinance. The allowable unit shear on the perimeter of the drop panel shall be three one-hundredths (3/100) of the ultimate compressive strength of the concrete. In computing shearing stress for the purpose of determining the resistance to diagonal tension the method specified by the ordinance shall be used.

Panel Strips.

(15) For the purpose of establishing the bending moments and the resisting moments of a square panel, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter (¼) of the panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips, the panel shall be divided into similar strips A and B, having the same widths and relations to the center line of the columns as the above strips. These strips shall be for designing purposes only, and are not intended as the boundary lines of any bands of steel used.

(16) These strips shall apply to the system of reinforcement in which the reinforcing bars are placed parallel and at right angles to the center line of the columns, hereinafter known as the two-way system, and also to the system of reinforcement in which the reinforcing bars are placed parallel, at right angles to and diagonal to the center line of the columns hereinafter known as the four-way system.

(17) Any other system of reinforcement in which the reinforcing bars are placed in circular, concentric rings and radial bars, or systems with steel rods arranged in any manner, whatsoever, shall comply with the requirements of either the two-way or the four-way system herein specified.

Bending Moment Coefficients, Interior Panel, Two-way System.

(18) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of the column capital or over it, shall be taken as $\frac{WL}{30}$

(19) The positive bending moment taken at a cross-section of each strip A midway between column centers, shall be taken as $\frac{WL}{60}$

(20) The positive bending moment taken at a cross-section of each strip B in the middle of the panel shall be taken as $\frac{WL}{120}$

(21) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as $\frac{WL}{120}$

(22) In the fomulas hereinabove given
"W" = total live and dead load on the whole panel in pounds,
"L" = panel length, center to center of columns.

Bending Moment Coefficients, Interior Panel, Four-way System.

(23) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of column capital or over it, shall be taken as $\frac{WL}{30}$

(24) The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as $\frac{WL}{80}$

(25) The positive bending moment taken at a cross-section of each strip, B, taken in the middle of the panel shall be taken as $\frac{WL}{120}$

(26) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as $\frac{WL}{120}$

Bending Moment Coefficients, Wall Panels.

(27) Where wall panels with standard drops and capitals are carried by columns and girders built in walls, as in skeleton construction, the same coefficients shall be used as for an interior panel, except as follows: The positive bending moments on strips A and B midway between wall and first line of columns shall be increased twenty-five (25%) per cent.

(28) Where wall panels are carried on new brick walls, these shall be laid in Port

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and cement mortar and shall be stiffened with pilasters as follows: If a sixteen-inch wall is used, it shall have a four-inch pilaster. If a twelve-inch wall is used, it shall have an eight-inch pilaster. The length of pilasters shall be not less than the diameter of the column, nor less than one-eighth (⅛) of the distance between pilasters. The pilasters shall be located opposite the columns as nearly as practicable, and shall be corbeled out four inches at the top, starting at the level of the base of the column capital. Not less than eight (8") inches bearing shall be provided for the slab, the full length of wall.

The coefficients of bending moments required for these panels shall be the same as those for the interior panels except as provided herewith: The positive bending moments on strips A and B midway between the wall and first line of columns shall be increased fifty (50%) per cent.

(29) Where wall panels are supported on old brick walls, there shall be columns with standard drops and capitals built against the wall which shall be tied to the same in an approved manner, and at least an eight-inch bearing provided for the slab, the full length. Where this is impracticable, there shall be built a beam on the underside of slab adjacent to the wall between columns, strong enough to carry twenty-five (25%) per cent. of the panel load.

The coefficients of bending moments for the two cases of slab support herein described shall be the same as those specified in Sec. 27 and Sec. 28 for skeleton and wall bearing condition respectively.

(30) Nothing specified above shall be construed as applying to a case of slabs merely resting on walls or ledges, without any condition of restraint. These shall be figured as in ordinary beam and girder construction specified in the Ordinances.

Bending Moment Coefficients, Wall and Interior Columns.

(31) Wall columns in skeleton construction shall be designed to resist a bending moment of $\frac{WL}{60}$ at floors and $\frac{WL}{30}$ at roof. The amount of steel required for this moment shall be independent of that required to carry the direct load. It shall be placed as near the surface of the column as practicable on the tension sides, and the rods shall be continuous in crossing from one side to another. The length of rods below the base of the capital and above the floor line shall be sufficient to develop their strength through bond, but not less than forty (40) diameters, nor less than one-third (1/3) the clear height between the floor line and the base of the column capital.

(32) The interior columns must be analyzed for the worst condition of unbalanced loading. It is the intention of this ruling to cover ordinary cases of eccentric loads on the columns by the requirement of Sec. 5. Where the minimum size of column therein specified is found insufficient, however, the effect of the resulting bending moment shall be properly divided between the adjoining slab and the columns above and below according to best principles of mechanics and the columns enlarged sufficiently to carry the load safely.

Bending Moment Coefficients, Panels Without Drops, or Capitals, or Both.

(33) In square panels where no column capital or no depressions are used, the sum total of positive and negative bending moments shall be equal to that computed by the following formula:

$$\text{B.M.} = \frac{WL}{8}(1.53 - 4k + 4.18k^3)$$

where B.M. = numerical sum of positive and negative bending moments, regardless of algebraic signs.

W = total live and dead load on the whole panel.

L = length of side of a square panel, c. to c. of columns.

K = ratio of the radius of the column or column capital to panel length, L.

This total bending moment shall be divided between the positive and the negative moments in the same proportion as in the typical square panels for two-way or four-way systems specified above for interior and wall panels respectively.

Points of Inflection.

(34) For the purpose of making the calculations of the bending moment at the sections away from the column capitals, the point of inflection shall be considered as being one-quarter (¼) the distance center to center of columns, both cross-wise and diagonally, from the center of the column.

Tensile Stress in Steel and Compressive Stress in Concrete.

(35) The tensile stress in steel and the compressive stress in the concrete to resist the bending moment shall be calculated on the basis of the reinforcement and slab in the width included in a given strip, and according to the assumption and requirements given in sections 758 to 761 inclusive of the building ordinance.

The steel shall be considered as being concentrated at the center of gravity of all the bands of steel in a given strip.

(36) For the four-way system of reinforcement the amount of steel to resist the negative bending moment over the support in each strip A shall be taken as the sum of the areas of steel in one cross band and one diagonal band. The amount of steel to resist the positive bending moment of each strip B shall be considered as the area of the steel in a diagonal band. The amount of steel to resist the positive bending moment in each strip A shall be considered as the area of the steel in a cross-band, and the amount of steel to resist the negative moment in each strip B shall be the steel included in the width of strip B.

(37) For the two-way system of reinforcement the amount of steel to resist the bending moment in any strip shall be considered as the area of steel included in the width of the strip.

(38) In both systems of reinforcement the compressive stress in the concrete in any strip shall be calculated by taking the area of steel considered for each strip, and applying it in a beam formula based on the principles of section 761 of the building ordinance.

(39) Where drop panels are used, the width of beam assumed to resist the compressive stresses over the column capital shall be the width of the drop.

(40) The width of beam where no drop panels are used, shall be the width of steel bands. Where this is found insufficient, the area shall be increased by introducing compression steel in the bottom of slab.

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Rectangular Panels.

(41) When the length of panel in either two-way or four-way system does not exceed the breadth by more than five (5%) per cent, all computations shall be based on a square panel whose side equals the mean of the length and breadth, and the steel equally distributed among the strips according to the coefficients above specified.

(42) In no rectangular panel shall the length exceed the breadth by more than one-third (1/3) of the latter.

Rectangular Panels, Four-Way System.

(43) In the four-way system of reinforcement where length exceeds breadth by more than five (5%) per cent, the amount of steel required in strip A, long direction, both positive and negative, shall be the same as that required for the same strip in a square whose length is equal to the long side of the rectangular panel.

(44) The amount of steel, strip A, short direction, positive and negative, shall be the same as that required for the same strip in a square panel, whose length is equal to the short side of the rectangular panel.

(45) The amount of steel in strip B, positive and negative, shall be the same as that required for similar strip in a square panel whose length is equal to the mean of the long and the short side of the rectangular panel.

(46) In no case shall the amount of steel in the short side be less than two-thirds (2/3) of that required for the long side.

Rectangular Panels, Two-way System.

(47) In the two-way system of reinforcement the amount of steel required for the positive and the negative moment of each strip A shall be determined in the same manner as indicated for the four-way system above.

(48) The amount of steel in strip B, positive and negative, running in short direction, shall be equal to that required for the same strip in a square panel whose length equals the long side of the rectangular panel.

(49) The amount of steel in strip B, long direction, positive and negative, shall be equal to that required for the same strip in a square panel, whose length equals the short side of the rectangular panel.

(50) In no case shall the amount of steel in strip B, long direction, be less than two-thirds (2/3) of that in the short direction.

Walls and Openings.

(51) Girders and beams shall be constructed under walls, around openings and to carry concentrated loads.

Spandrel Beams.

(52) The spandrel beams or girders shall, in addition to their own weight and the weight of the spandrel wall, be assumed to carry twenty (20%) per cent of the wall panel load uniformly distributed upon them.

Placing of Steel.

(53) In order that the slab bars shall be maintained in the position shown in the design during the work of pouring the slab, spacers and supports shall be provided satisfactory to the Commissioner of Buildings. All bars shall be secured in place at intersections by wire or other metal fastenings. In no case shall the spacing of the bars exceed nine inches (9"). The steel to resist the negative moment in each strip B shall extend one-quarter (¼) of the panel length beyond the center line of the columns in both directions.

(54) Splices in bars may be made wherever convenient, but preferably at points of minimum stress. The length of splice beyond the center point, in each direction, shall not be less than forty diameters (40d) of the bars, nor less than two feet (2'0"). The splicing of adjacent bars shall be avoided as far as possible.

(55) Slab bars which are lapped over the column, the sectional area of both being included in the calculations for negative moment, shall extend not less than twenty-five one-hundredths (.25) of the panel length for cross-bands, and thirty-five one-hundredths (.35) of the panel length for diagonal bands, beyond the column center.

Computations.

(56) Complete computations of interior and wall panels and such other portions of the building as may be required by the Commissioner of Buildings shall be left in the office of the Commissioner of Buildings when plans are presented for approval.

Test of Workmanship.

(57) The Commissioner of Buildings or his representative may choose any two adjacent panels in the building for the purpose of ascertaining the character of workmanship. The test shall not be made sooner than the time required for the cement to set thoroughly, nor less than six weeks after the concrete has been poured.

(58) All deflections under test load shall be taken at the center of the slab, and shall be measured from the normal unloaded position of the slab. The two panels selected shall be uniformly loaded over their entire area with a load equal to the dead load plus twice the live load, thus obtaining twice the total design load. The load shall remain in place not less than twenty-four (24) hours. If the total deflection in the center of the panel under the test load does not exceed one eight-hundredth (1/800) of the panel length, the slab may be placarded to carry the full design live load. If it exceeds this amount of deflection, and recovers not less than eighty per cent (80%) of the total deflection within seven days after the load is removed, the slab may be placarded to carry the full design live load. If the deflection exceeds the allowable amount above specified, and the recovery is less than eighty per cent (80%) in seven days after the removal of the test load, other tests shall be made on the same or other panels, the results of which will determine the amount of live load the slabs will be permitted to carry.

General.

(59) The design and the execution of the work shall conform to the general provisions and the spirit of the Chicago Building Ordinances in points not covered by this Ruling, and to the best engineering practice in general.

Enforcement.

(60) This ruling shall be in effect on and after March first, Nineteen Hundred and Eighteen (March 1st, 1918), and shall supersede all previous rulings on flat slabs.

Signed: CHAS. BOSTROM,
Commissioner of Buildings.

FIREPROOFING OF REINFORCED CONCRETE COLUMNS.

IV

In reference to Section 762-j and Section 776 of the Chicago Building Ordinance, the Commissioner has ruled that in buildings classed as ordinary construction the full section of the column may be calculated in columns reinforced with vertical rods only. In buildings classed as slow burning or mill construction, the outside one and one-half inches shall not be figured in columns reinforced with vertical rods only, and in buildings classed as fireproof construction the outside two inches shall not be figured in the strength of columns with vertical rods only. When spiral reinforcement is used, only the area within the core shall be figured in accordance with Section 764-b.

Home of Fred P. Warren
Evanston, Ill.

Reginald D. Johnson, Architect
Pasadena, Calif.

ROBERT BLACK COMPANY

Building Contractors

FACTORIES, WAREHOUSES, INDUSTRIAL,
HIGH GRADE RESIDENCES, AND REMODELLING.

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CHICAGO

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CAISSONS.

V

Ruling.—The Commissioner has ruled that in determining the area required for concrete caissons, the load on the caissons shall be the load for which the basement column was designed, and the allowable stress on the concrete shall be as given in Section 746 (a). The allowable stress used shall be the stress at the top of the caisson.

A RULING ON COUNTERBALANCE OF STAIRWAY FIRE ESCAPES.

VI

The Commissioner of Buildings has made a ruling in regard to the construction of the movable part of stairway fire escapes as follows:

All counterbalance stairway fire escapes hereafter constructed shall conform to the following requirements in addition to those specified in the Building Ordinance for fixed stairway fire escapes, Section 882.

(a) The stringer carrying the counterweight may be built of steel channels, angles or "I" beams or any combination thereof, not less than eight inches deep and ⅜" metal, but it shall be so designed that the maximum fibre stress over the support shall not exceed 8,000 pounds per square inch and the moment of inertia about the vertical axis parallel to the web of the stringer shall not be less than 33% of the moment of inertia about the horizontal axis perpendicular to the web and passing through the center, which shall be accomplished by riveting an angle or angles onto the channel or "I" beam stringer.

(b) The same section of stringer shall be continued for equal distances on either side of the support and the reinforcement shall be extended as close to the counterweight as practicable

(c) The truss rod from the counterweight to the opposite end of the stringer shall always be used either as an independent brace or in connection with the railing to prevent any sag of the stringer and shall be at least ¾" in diameter firmly connected, the strength of connection to be sufficient to develop the strength of the rod, but in figuring stresses, the stringer must be assumed to carry the total dead and live load as required by the ordinance.

(d) The connection between the stringer and the supporting rod must be designed to stiffen the stringer securely against horizontal or twisting motion by means of a steel casting or forging riveted to the stringer both through the web and the flange.

ILLUMINATED AND OTHER ROOF SIGNS OF STEEL SKELETON CONSTRUCTION.

VII

In regard to Section 919, of revised Building Ordinances, the Commissioner has ruled that all illuminated roof signs of steel construction shall conform to the following specific requirements:

(a) All compression members shall be proportioned by the usual formula, 16,000-70 l except that the length of the main or principal members R may be increased to one hundred and seventy-five (175) times the least radius of gyration, and the length of all secondary or sub-members may be increased to two hundred (200) times the same.

(b) The anchorage of every roof sign shall be designed with a factor of safety not less than two (2), i. e., there shall be at least twice as much weight of masonry or concrete resisting the pull on the anchors as figured from the overturning effect of wind.

(c) The thickness of all structural steel members shall not be less than one-fourth (¼) of an inch.

Chicago, March 15th, 1916.

With reference to Section 743 (h) of the Revised Building Ordinances, the Commissioner has ruled that,

(a) Whenever two or more rows of piles are required, the distance between the center lines shall not be less than the largest diameter of the piles.

(b) When a single staggered row of piles is used, the distance between the center lines shall not be less than one-half the largest diameter of the piles, except that in one-story buildings or walls less than twenty feet high a single row without any staggering may be used.

(c) The piles shall be driven so that the distance between centers shall not be less than twice the largest diameter nor two feet six inches minimum.

RULING GOVERNING THE MINIMUM THICKNESS OF METALS.

VIII.

In steel construction exposed to the weather, no metal in principal members shall be less than 5-16 inch thick, except the webs of "I" beams or channels which may be ¼ inch thick but not less. For secondary members, no metal shall be less than 1-4 inch thick, except that webs of channels or "I" beams used as secondary members may be 3-16 inch thick, but not less. This ruling is not to apply to electric signs or fire escapes or canopies.

In steel construction protected by buildings no metal in a principal member shall be less than 1-4 inch thick, except that closed sections filled with concrete and the webs of channels and "I" beams may be 3-16 inch thick, but not less. For secondary members metal may be 3-16 inch, but not less.

The above rulings to take effect August 28, 1916.

RULING ON REINFORCED CONCRETE FLOORS.

IX.

In regard to Sec. 776 referring to fireproofing concrete floors, the Commissioner has ruled that the following interpretation shall apply to concrete joist and floor tile construction:

(a) Whenever a combination of reinforced concrete joists and hollow burned clay tile fillers is used, the same shall be assumed same as solid concrete slabs as far as fireproofing of steel rods is concerned.

(b) Whenever a system of concrete joists and steel or plaster domes instead of clay tiles is used, whether same is left in place or withdrawn afterwards, the combination shall be assumed and be subject to same requirements as reinforced concrete beams and girders, with the exception that steel reinforcement in the top of the joists may be considered as in solid slab construction.

(c) Whenever cement plaster ceiling on metal lath is used in connection with the latter type of construction, one-half inch may be deducted from the required amount of fireproofing at the bottom and the sides of joists, provided that cement plaster not less than three-fourths inches thick be applied directly to the under side of joists.

RULING GOVERNING STAR-SHAPED COMPRESSION MEMBERS.

X.

In regard to columns or struts built of two angles placed back to back in star-shape ⊣ ⊢, the Commissioner has ruled that the same should comply with the following specifications:

1. Star-shaped compression members shall be tied together by pairs of batten plates or pairs of angle lugs in opposite directions spaced not more than three (3) times the width of main member center to enter of each successive pair.

Eastgate Hotel, Chicago — Oman & Lilienthal, Architects

ARDMORE 1410-1411

H. JANISCH & COMPANY

Building Construction

1801-1813 WINONA STREET — CHICAGO

2. Each batten plate or angle lug shall have enough rivets connecting it to each angle of the column or strut to be able to transfer fifteen (15%) per cent of total stress in the member from one angle to the other through the rivets when these are figured in single shear.

3. Minimum size of rivets shall be as follows:

⅞" diameter for 8" angles.
¾" diameter for 6", 5" and 4" angles.
⅝" diameter for 3" and 2½" angles.

4. Minimum spacing of rivets shall be three (3) inches for single row and two and one-half (2½) inches for double row, staggered, measured parallel to the gage lines. When two gage lines are used, rivets must be staggered.

5. Minimum thickness of strut angles or batten plates shall be one-fourth of an inch (¼) when exposed to weather, and three-sixteenth (3-16) inches when protected within a building, but batten plates or angle lugs shall not be less than two-thirds (2-3) the thickness of the main compression members.

CINDER FILLS ON BUILDINGS.

XI.

Cinder fill on Buildings will be figured at the rate of 66 lbs. per cubic foot unless evidence of exact weight is furnished.

PLATFORMS FOR GRAVITY TANKS.

XII.

Platform beams supporting gravity tanks shall have webs $\frac{5}{16}$" thick or more, where the webs are inaccessible for painting the web shall be not less than ⅜" thick.

RIVETS IN TENSION.

XIII.

When rivets are used in tension in wind bracing they may be figured at 18,000 lbs. per square inch if machine driven and 15,000 lbs. per square inch if hand driven.

ROOF ARCHES OF WOOD, STEEL, REINFORCED CONCRETE, STONE OR MASONRY.

XIV.

Use the usual methods given in standard text books on elastic arches fixed or hinged at the ends, for obtaining the critical moments and shears.

The stresses shall be figured on the following basis:—

(1) For the actual dead load acting on the full span of the arch.

(2) For a vertical live load of 25 pounds per sq. ft., acting on such lengths of the arch as will give the maximum moments and shears.

(3) For a horizontal wind-load of 20 pounds per sq. ft. acting on one-half of the arch obtain the normal wind brace, Duchemin's Formula. If rollers are used under one end of arch, the wind-load shall be assumed to act on either side of the structure.

(4) For a temperature effect of 50 degrees F. above and below the average.

(5) For the actual maximum erection stresses possible.

For loadings (1), (2), (3), (4) and (5) combined or for the critical combination of these loadings the stresses given in the Ordinance may be increased (50) per cent.

Apply the ordinary Column-Formulas to the arch, considering the arch as a curved column of a length equal to ½ the length of the arch. Do the same thing laterally, by considering the arch as a straight column of a length equal to the spacing of the struts of the lateral bracing system.

Figure the Monent stresses in the arch same as in an ordinary beam.

When rollers are used under one end of the arch, such arch shall be analyzed for a wind load acting on either side of the roof. The maximum stresses for any load or combination of loadings shall be considered.

Approved by the Commissioner of Buildings, November 8, 1921.

CONCRETE JOIST AND TILE CONSTRUCTION.

XV.

In regard to Section 776 applied to concrete joist and tile construction:

(a) When a combination of concrete joist and clay tile filler is used, it shall be assumed the same as solid concrete slab as far as fireproofing steel rods are concerned.

The top shall, for all floors and for fireproof roofs, have a minimum thickness of 2 inches, and for roofs other than fireproof a minimum thickness of 1½ inches. The reinforcing rods perpendicular to the joists shall be spaced not more than 12-inch centers, and must contain an equivalent of ¼ round spaced 12-inch centers.

(b) When a system of concrete joist and steel or plaster domes is used, whether the domes are left in or withdrawn, the combination shall be subject to the same requirements as reinforced concrete beams and girders, except that the steel in top may be considered as in solid slab construction.

The minimum thickness of top for a fireproof floor or roof without cinder concrete over shall be 2½ inches, and with cinder concrete or other fireproof material over shall be 2 inches. For other floors the minimum thickness shall be 2 inches, and for other roofs 1½ inches.

When plaster ceiling either suspended or applied directly on the underside of the joists, on metal lath is used, one-half inch may be deducted from the required amount of fireproofing at the bottom and sides of the joists.

The reinforcing rods in the top perpendicular to the joists shall be spaced not more than six times the thickness of the slab and must contain an equivalent of ¼ round, spaced 12-inch centers.

(c) The thickness and reinforcing referred to above, for tops of floors, are the minimum requirements. The design must meet the necessities of the loads and spans in all respects.

This ruling to be effective until negatived by the Commissioner of Buildings.

BRICK STACKS.

XVI.

The allowable extreme fibre stress in tension for brick stacks or for plain or radial terra cotta stacks shall not exceed 17.5 pounds per square inch, when laid in a mortar composed of at least one part Portland cement to one part lime and three parts sand.

Approved by the Deputy Commissioner,
ROBERT KNIGHT.

RULING FOR REINFORCED CONCRETE HOOPED COLUMNS.

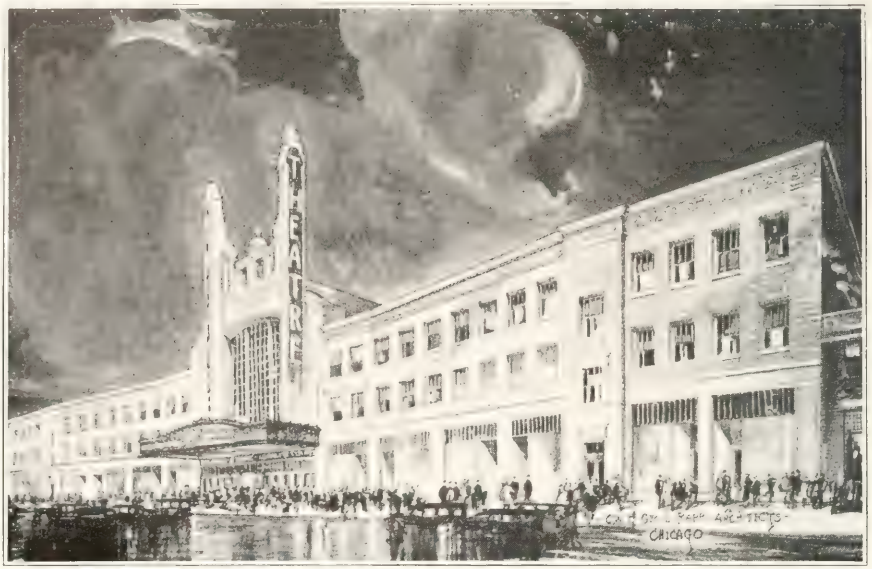
XVII.

Reinforced concrete hooped columns may be used for longer lengths than twelve (12) times the least width, provided the maximum working unit stress on the core of such axially loaded columns is determined by the formula:

$$\frac{P^1}{P} = 1.40 - \frac{L}{120\,R}$$

where

P^1 = total safe axial load on long columns.
P = total safe axial load on column of the same section, whose L/D is less than 12.



Balaban & Katz Theatre Bldg., Howard Ave., Chicago — C. W. & Geo. L. Rapp, Architects

DUFFY-NOONAN CONSTRUCTION CO.

140 S. DEARBORN STREET

CHICAGO

TELEPHONES: RANDOLPH 2680-0843

R = least radius of gyration of column core.
L = unsupported length of column in inches.
D = least side of column in inches.

Approved July 29, 1924,
FRANK E. DOHERTY,
Commissioner of Buildings.

NOMENCLATURE.

XVIII.

f_s denotes unit fibre stress in steel.
f_g denotes unit fibre stress in gypsum.
E_s denotes modulus of elasticity of steel.
N_g denotes modulus of elasticity of gypsum.
n denotes ratio E_s/E_g.
M_s denotes resisting moment as determined by steel.
M_g denotes resisting moment as determined by gypsum.
M denotes bending moment in general.
b denotes breadth of tile.
d denotes distance from compressive face to the plane of the steel.
k denotes ratio of the depth of the neutial axis of a section below the top to "d."
j denotes ratio of the arm of the resisting couple to "d."
A denotes area of cross-section of steel.
p denotes steel ratio A/bd.
w denotes total uniform load per sq. ft. of tile.

STRESSES.

5"x18"x6'-0" Channel Tile.

Type "D" Mat.
One $\frac{3}{16}$" rod each rib

Area 2—No. 7 wires=0.0492
3" rods=0.0552
Area 2— 16 A =0.1044 sq. in.

$p=\frac{A}{bd}=\frac{.1044}{18\times4.25}=.00136$

$n=30 \qquad pn=.0408$

$k=2\,pn+(pn)^2-pn=0.2572$

$j=1-\frac{K}{3}=.9143$

$Af_sjd=\frac{1}{8}\,WL^2\times12$ For $f_s=16000$, $w=\frac{Af_sjd}{1,5L^2}=\frac{0,1044\times16000\times.9143\times4.25}{1.5\times36}=120$ lbs.

$\frac{120}{1.5}=80$ lbs. per sq. ft. of slab with 16000 lbs. stress in steel.

$M=\frac{1}{8}\,W.L.^2\times12=6475''$ lbs.

$fg=\frac{2M}{jk\,bd^2}=\frac{2\times6475}{.9143\times0.2572\times18\times(4.25)^2}=170$ lbs.

$Shear=\frac{120\times3}{3+2\times4.25\times2}=16.9$ lbs. per sq. in. in rib.

For a total load of 50 lbs per sq. ft. of slab:
$M=1.5\times75\times36=4050''$ lbs.

$f_s=\frac{M}{Ajd}=\frac{4050}{.1044\times.9143\times4.25}=10000$ lbs.

$fg=\frac{2M}{jk\,bd^2}=\frac{2\times4050}{.9143\times2572\times18\times(4.25)^2}=106.5$ lbs.

$Shear=\frac{75\times3}{3+2\times4.25\times2}=10.6$ lbs. per sq. in. in rib.

STANDARD SPECIFICATIONS COVERING THE MANUFACTURE OF PYROBAR LONG SPAN GYPSUM ROOF TILE FOR USE IN BUILDINGS OF ORDINARY CONSTRUCTION.

Approved September 28, 1923.

By ROBERT KNIGHT

1. The gypsum used shall be second settle stucco, having an ultimate compressive value of not less than 2,000 pounds per square inch.

2. Reinforcing as indicated on sheet headed "Stresses" shall be properly placed and secured in form.

3. Thirty-seven parts by weight of water shall be added to sixty-three parts by weight of second settle stucco, the materials thoroughly mixed and poured in the form, care being taken to see that the reinforcing remains in its proper position.

4. After setting of the gypsum, the tile shall be removed from the form and placed in a kiln until thoroughly dry.

STRESSES IN THE PYROBAR LONG SPAN GYPSUM ROOF TILE SHALL NOT EXCEED VALUE GIVEN BELOW.

1. Tensile stress in steel shall not exceed one-third its elastic limit and shall not exceed 16,000 lbs. per sq. inch.

2. Shearing stress in steel shall not exceed 10,000 lbs. per square inch.

3. Direct compression in gypsum shall be one-fifth of its ultimate strength, but shall not exceed 150 lbs. per square inch. Bending in extreme fibre shall be same value as determined for direct compression.

4. Bearing of gypsum shall not exceed 200 lbs. per square inch.

5. Bond between gypsum and reinforcing steel shall not exceed the following values:

21 lbs. per sq. in. for plain square bars.

25 lbs. per sq. in. for plain round bars.

30 lbs. per sq. in. for bars with mechanical bond.

6. Tension in gypsum. Gypsum is assumed not to take tension, and full reinforcement is always provided.

7. Shearing stress in plain unreinforced gypsum shall not exceed 6 lbs. per square inch. When reinforcing is provided for diagonal tension and the horizontal steel is properly anchored, the shearing stress on the gypsum may be increased to 20 lbs. per square inch.

COMPOSITION.

Physical.

Percentage of gaging water for standard consistency.

37. Dry bulk—cc's per gm. .88.

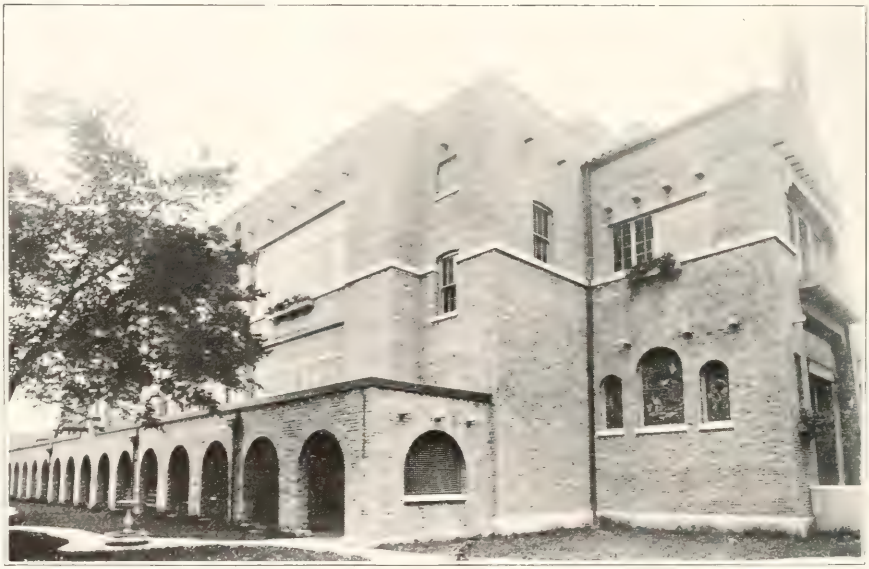
Fineness—through 100 mesh, 84.6%.

Chemical.

Percentage moisture combine water	5.83
C & O	37.00
CaSO4	52.00
Insoluble silicates	3.12
Fe203 A1203	.67
CaO	.52
CaCO3 CO2	trace
MgO	
NaCL	.07

Interior of St. Gregory's Church,
Gregory & Paulina Sts., Chicago

Comes, Perry & McMullen,
Architects, Pittsburgh



St. Margaret Mary's Church and School,
[illegible] Chase Ave., Chicago

Joseph W. McCarthy,
Architect

MATH RAUEN CO.

GENERAL CONTRACTORS

326 West Madison Street, Chicago

Phones Main 3086-3265

PYROBAR GYPSUM ROOF TILE. INGREDIENTS AND PROCESS OF MANUFACTURE.

Gypsum is either quarried or mined, depending upon how far below the surface the gypsum strata occurs. Gypsum is mined in much the same manner as coal. The rock is broken to one man size, then weighed and passed over a set of grates which screen out the smaller pieces. The larger pieces go through a gyratory crusher, and are crushed to what is termed "crushed rock." After leaving the crusher, the rock is run through a rotary screen where it is sized for shipment to the trade and for mill use. After delivery to the mill, it is recrushed in the swing hammer mill to about three-quarters inch size. It is then put through a rotary dryer and the surface moisture removed. The temperature in that dryer is about 150° F. This leaves the crushed gypsum bone dry and ready for grinding. The dry rock is then ground on Munson Mills to a fineness of 85%, through a 100 mesh. It is then fed into the calcining kettles to be calcined. These kettles are cylindrical in shape about 10 feet in diameter, about 15 feet high, and hold approximately twelve tons of stucco.

As the heat is applied, the gypsum commences to give up the water which is chemically combined in it. The temperature to which the gypsum in the kettle is subjected, runs about 380° F. This calcining process takes about an hour and a half, at the end of which time it gradually settles to what might be called a quiescent state. By increasing the temperature to about 450° F., the mass again comes to a boil and settles a second time. It is because of the gypsum settling in the kettle that the plaster is referred to as first or second settle stucco. In first settle stucco, about 75% of the water of crystallization is removed, and in second settle, a little more is evaporated. Second settle stucco makes a great deal denser gypsum, and is used for our long span roof tile and floor tile. First settle stucco is used for wall plaster and partition tile.

After the calcining process, the stucco is fed over the scalping screens, which automatically remove any foreign matter. It is then conveyed to the storage bin.

The second settle stucco or Structolite, as it is termed, is now ready to be made into roof tile. No foreign ingredients are added; simply water and Structolite, using 63% by weight of Structolite and 37% of water.

Ground, dry Structolite, before the water is added, weighs 65 lbs. per cubic foot, and after adding the water, the finished product weighs 77 lbs. per cubic foot.

Approved by Robert Knight, Deputy Commissioner of Buildings, September 28, 1923, for buildings of ordinary construction.

Not valid for gypsum slabs cast in place at the building.

—B. E. W.

CHICAGO ZONING ORDINANCE

(Passed by the City Council of the City of Chicago on April 5, 1923; Approved by the Mayor on April 16, 1923)

AN ORDINANCE.

An Ordinance establishing a plan for dividing the City of Chicago into districts for the purpose of regulating the location of trades and industries and of buildings and structures designed for dwellings, apartment houses, trades, industries, and other specified uses, for regulating the height, volume, and size of buildings and structures, and intensity of use of lot areas, for determining building lines, and for creating a board of appeals.

Be it ordained by the City Council of the City of Chicago:

Section 1. **Interpretation; Purpose.** In interpreting and applying the provisions of this ordinance such provisions shall in every instance be held to be the minimum requirements adopted for the promotion of the public health, safety, comfort, morals or welfare.

Section 2. **Definitions.** Certain words in this ordinance are defined for the purposes thereof (unless there is express provision excluding such construction or the subject matter or context is repugnant thereto) as follows:

(a) Words used in the present tense include the future; the singular number includes the plural and the plural the singular; the word "building" includes the word "structure".

(b) **Alley**—A narrow thoroughfare upon which abut generally the rear of premises, or upon which service entrances of buildings abut, and is not generally used as a thoroughfare by both pedestrians and vehicles, or which is not used for general traffic circulation, or which is not in excess of 30 feet wide at its intersection with a street.

(c) **Apartment House**—A building which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(d) **Auxiliary Use**—A use customarily incidental to and accessory to the principal use of a building or premises located on the same premises with such principal use.

(e) **Block**—A block shall be deemed to be that property abutting on a street on one side of such street and lying between the two nearest intersecting or intercepting streets, or nearest intersecting or intercepting street and railroad right of way or waterway.

(f) **Building**—A building is a structure entirely separated from any other structure by space or by walls in which there are no communicating doors or windows or similar openings.

(g) **Depth of Lot**—The depth of a lot is the mean distance from the front street line of the lot to its rear line measured in the general direction of the side lines of the lot.

(h) **Dwelling House**—A building used or intended to be used as a home or residence in which all living rooms are accessible to each other from within the building and in which such living rooms are accessible without using an entrance vestibule, stairway or hallway that is designed as a common entrance vestibule or common stairway or common hallway for more than one family, and in which the use and management of all sleeping quarters, all appliances for cooking, ventilating, heating, or lighting, other than a public or community service, are under one control.

(i) **Family**—One or more individuals living, sleeping, cooking and eating on the premises as a single housekeeping unit.

(j) **Grade**—The finished grade of premises improved by a building is the elevation of the surface of the ground adjoining the building. The established grade of premises whether vacant or improved is the elevation of the sidewalk at the property line as fixed by the

Chicago Office of Coral Gables — Frederick M. Hodgdon, Architect

Thos. G. Gage Co.

General Contractors

64 W. Randolph Street — CHICAGO, ILL.

City. Where the finished grade is below the level of the established grade, the established grade shall be used for all purposes of this ordinance.

(k) **Garage**—A public garage, except as otherwise provided by this paragraph, is a building or premises arranged, designed, and intended to be used for the storage of motor vehicles for hire or reward, or which does not come within the definition of a private or community garage as herein set forth. A private garage is a building with ground area not in excess of 80 square feet arranged, designed, and intended to be used for the storage on the ground floor of not more than 4 individually owned passenger automobiles devoted to the private use of the owner, when such garage is located on the same premises, as an auxiliary use, with the residence or apartment or business of the owner of such automobiles so stored, and where no fuel is sold. A use as a private stable shall be subject to the same ground area regulations for the purposes of this ordinance as the regulations controlling the ground area of a private garage. Where two or more separate private garages, each having a ground area not in excess of 200 square feet, are located on the rear half of the premises, not more than one of such garages having a vehicle entrance on a public street, such garages collectively shall be deemed a community garage, but a group of two or more private garages on a single lot not so located or arranged or any one of which is in excess of 200 square feet in area shall be deemed a public garage.

(l) **Height of Building**—The height of a building shall be the vertical distance measured in the case of flat roofs from the mean level of the established grade to the level of the highest point of the under side of the ceiling beams adjacent to the street, and in the case of a pitched roof from such grade to the mean height level of the under side of the rafters of the gable. Where a block has a frontage on a two-level street the upper street level may be used to determine the height of buildings for a distance back from such frontage not in excess of one-half the depth of the block at right angles to such frontage, but not farther back than the alley most nearly parallel to such street in any case. Where a structure is set back from the street line, the mean level of the finished grade of the premises along the line of that part of the structure nearest the street line may be substituted for the established grade for the purpose of determining the height of a building. Where no roof beams exist or there are structures wholly or partly above the roof, the height shall be measured from the established grade or finished grade to the level of the highest point of the building.

(m) **Lot**—A parcel of land or premises occupied, or which it is contemplated shall be occupied, by one building with its usual auxiliary buildings or uses customarily incident to it, including such open spaces as are required by this ordinance and such open spaces as are arranged and designed to be used in connection with such building, shall be deemed a lot for the purposes of this ordinance. A corner lot shall be deemed to be that property which has an area not in excess of 8,000 square feet, and which abuts on two streets making an angle on the lot side of not greater than 120 degrees.

(n) **Non-conforming Use**—A non-conforming use is a use which does not comply with the regulations of the use district in which it is situated.

(o) **Public Space**—A park, public square, or submerged land under the jurisdiction of a park district shall be deemed a public space.

(p) **Street**—A thoroughfare used for public foot and vehicle traffic other than an alley as herein defined, shall be deemed a street.

(q) **Street Line**—The street line is the dividing line between a street and the lot. The front street line shall be deemed to be the shortest street line.

(r) **Street Wall**—The street wall, for the purposes of this ordinance, shall be deemed that wall or part of a wall of a building, or that part of the wall of a porch or other structure, nearest to and most nearly parallel with the street, extending more than 4 feet 6 inches above the finished grade.

(s) **Volume of Building**—The volume of a building shall be the contents in cubic feet of that space between the grade used in determining the height of buildings and the mean level of the roof (except as otherwise specifically provided by Section 16, Paragraph (a),) including scenery lofts and other storage spaces, cooling towers, elevator bulkheads, towers, penthouses, water tanks or water towers, dormers, bays, covered ways, covered porches or other spaces not open to the sky, and courts, provided that certain courts or certain parts thereof opening on thoroughfare or public spaces, cornices projecting beyond the exterior walls, piers or columns, or the space under the projection of a cornice, chimneys, parapet walls, structures extending into thoroughfares or public spaces, architectural finials or open framework wireless towers shall not be included as a part of the volume of a building. No court except an open court unobstructed from the street or alley or other public place by walls for its full width shall be excluded from the volume of a building. An offset court opening on an open court but having a wall between the offset court and the thoroughfare or public place, or that part of a court not open to the sky, shall not be within the definition of an open court or of a part of an open court. The distance between the mean level of the top of the enclosing walls of the court and the mean level of the bottom of the court shall be used to determine the volume of such court.

Section 3. **Use of Districts.** For the purpose of classifying, regulating and restricting the location of trades and industries and the location of buildings designed for specified industrial, business, residential, and other uses, the City of Chicago is hereby divided into four classes of districts: (1) Residence districts, (2) Apartment districts, (3) Commercial districts, and (4) Manufacturing districts; as shown on the use district map which accompanies this ordinance. The said use district map, consisting of forty-nine separate parts all of which are sections of the same map covering the entire territory of the City, the volume district map, also containing forty-nine parts each of which relates to the corresponding part of the use district map, and the index map and chart containing the explanation of symbols and indications which appear on said use district and said volume district maps, are hereby made a part of this ordinance. The use districts designated on said map are hereby established. No building shall be erected nor shall buildings or premises be used for any purpose other than a purpose permitted by this ordinance in the use district in which such building or premises is or are located.

Section 4. **Residence Districts.** (a) In a Residence district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for an A, C, or M use as defined hereinafter. In a Residence district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, R uses are hereby defined as uses designed for and permitted in Residence districts and conforming to the provisions relating to such districts; and all R uses are classified as R1, R2, R3, or R4 uses as follows:

R1 Use—An R1 use shall include every use as a dwelling house.

R2 Use—An R2 use shall include every use as golf or tennis grounds or similar use, church, convent, parish house, public recreation building, community center building, mu-

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sic school, university, public school, juvenile dancing school, or a private or boarding school or college unless such private or boarding school or college is operated so as to bring it within the definition of a C use.

R3 Use—An R3 use shall include every use as a public park, public playground, or railway passenger station.

R4 Use—An R4 use shall include every use as a tree or plant nursery, farm, truck garden, greenhouse (unless such greenhouse is operated as a retail business), and a railway right of way not including yard tracks or industrial tracks.

Section 5. **R Use Limitations.** In a Residence district no building shall be erected or used and no building shall be erected which is arranged, intended, or designed for an R2 use unless such building or use is located—

On premises adjoining a street under the jurisdiction of a park district;

On premises adjoining or across a street or alley from a railway right of way;

On premises on the same street and adjoining premises or directly across a street from premises where there exists a building devoted to an R2 or R3 or special use as hereinafter defined;

On corner premises diagonally or directly across a street from premises upon which is maintained an R2 or R3 or special use;

On premises entirely surrounded by streets or alleys;

On premises three sides of which adjoin streets;

On premises adjoining or immediately across a street from an Apartment, Commercial or Manufacturing district;

On premises adjoining on the same street premises where there exists a building devoted to a non-conforming use;

On premises already devoted to an R2 or R3 or special use; or

On premises located in a block in which there are no premises devoted to dwelling house purposes.

Section 6. **Apartment Districts.** (a) In an Apartment district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for a C or M use as defined hereinafter. In an Apartment district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R or A uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, A uses are hereby defined as uses other than R uses, designed for and permitted in Apartment districts and conforming to the provisions relating to such districts; and all A uses are classified as A1, A2, or A3 uses as follows:

A1 Use—An A1 use shall include every use as an apartment house.

A2 Use—An A2 use shall include every use as a boarding house, lodging house, or a hotel which is maintained within the limitations in Apartment districts imposed thereon by this ordinance.

A3 Use—An A3 use shall include every use as a public library, public museum, public art gallery, hospital or sanitarium, an eleemosynary institution except as otherwise classified, or a private club excepting a club the chief activity of which is a service customarily carried on as a business.

Section 7. **Auxiliary Uses in Residence or Apartment Districts.** (a) Auxiliary uses which do not alter the character of the premises in respect to their use for residential purposes shall be permitted in Residence and Apartment districts. Auxiliary uses shall include the following, but the enumeration of such cases shall not be deemed to prevent proper auxiliary uses that are not referred to:

Signs advertising the premises for sale or for rent which are located (if space occupied by buildings does not prevent) not nearer to adjoining premises than 8 feet or nearer to a street line than the building line established by this ordinance;

The office of a surgeon, physician or dentist, located in the dwelling or apartment used as the private residence of such surgeon, physician or dentist;

Customary home occupation located in a dwelling, studio, or apartment and carried on only by the members of the household of the person occupying such dwelling, studio, or apartment as his private residence, provided no window or other display or sign is used to advertise such occupation;

The renting of one or more rooms or the providing of table board in a dwelling or apartment occupied as a private residence, provided no window or other display or sign is used to advertise such use;

A public dining room or restaurant located in a hotel provided that the public entrance to such dining room or restaurant is from the lobby of the hotel, and further provided that no window or other display or sign is used to advertise such use;

Such facilities or retail shops as are required for the operation of a hotel or apartment house, or for the use or entertainment of guests or tenants of the hotel or apartment house, when conducted and entered only from within the building; provided no street window or other exterior display or other exterior sign is used to advertise such use; and further provided that in an apartment district which is also in a 4th or 5th volume district, at any time after ten years from the time of the passage of this ordinance but not previously (and no construction shall be given to the following language which would permit the uses therein named or any of them before the expiration of said ten year period), an auxiliary use shall be deemed to include a retail shop on the ground floor of an apartment house or hotel (which apartment house or hotel is not less in height than 120 feet), such shop having a store front with show windows on and an entrance from a street, with such signs only as are on the glass of said window or entrance door; provided, however, that no such retail shop, such store front or entrance, or such sign shall be used for any purpose or business (1) which is not suitable to the neighborhood and to the main occupancy of said apartment house or hotel, (2) which involves the trucking of material through the abutting or adjacent streets or alleys in sufficient quantities to produce undue congestion in such streets or alleys or to interfere with the usual functioning of those streets or alleys, or (3) which is of such character as an automobile or automobile tire or accessory business, or heavy machinery display or sales room, garage, meat market, bakery, grocery store, hardware store, ice cream parlor, soda water fountain, gasoline filling station, street front lunch room or cafeteria, undertaking establishment, laundry, amusement place, or any other use of an objectionable character; and the specific enumeration above of certain uses shall not be held to exclude other uses which are unsuited to the neighborhood although not specifically enumerated.

Private dining halls, dormitories, printing presses, students' laboratories or workshops, playgrounds, athletic fields, or other customary facilities in connection with an R2 use;

A news or refreshment stand or restaurant in connection with a passenger station;

Recreation and service buildings in a public park or public playground;

A private garage or private stable in connection with an R use, limited in ground area to 10 per cent of the area of the lot, but not in excess of the ground area prescribed for or in excess of the capacity limits of a private garage; provided, however, that a private garage or private stable in connection with an R use shall not be located on the same lot with another private garage or private stable or community garage;

A private garage or private stable or community garage in connection with an A use

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in an Apartment district, limited in ground area to 15 per cent of the area of the lot, provided that a community garage auxiliary to an A1 use shall not be composed of a greater number of private garages than the number of separate dwelling apartments located on the same lot.

(b) Auxiliary uses shall not include:

A garage or stable in connection with a non-conforming use except a private garage or private stable whose ground area does not exceed 10 per cent of the area of the lot;

A driveway or walk used for access to a C or M use;

A billboard, signboard or advertising sign, store, trade, business, garage or stable, except such as are hereinbefore specifically permitted.

Section 8. **Commercial Districts.** (a) In a Commercial district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for M uses as defined hereinafter. In a Commercial district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R, A, or C uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, C uses are hereby defined as uses other than R and A uses, designed for and permitted in Commercial districts, and conforming to the provisions relating to such districts; and all C uses are further defined and classified as C1, C2, or C3 uses as follows:

C1 Use—A C1 use shall include every use as

Airplane hangar or airplane repair shop;

Amusement park or pier, skating rink, baseball park, or race track, if such park or pier, rink, baseball park, or track is operated as a business for purposes of private profit;

Armory or arsenal, except where ammunition is manufactured;

Automobile repair shop, automobile parts or tire repair or vulcanizing shop, public garage, automobile fuel or service station;

Advertising sign;

Convention hall;

Driveway or walk used for access to any C or M use;

Financial institution;

Greenhouse operated as a retail business;

Internal combustion engine operated in connection with any use permitted in a Commercial district, provided such engine is equipped and operated only with a competent muffling device;

Office;

Public or private institution, except an institution otherwise classified;

Railroad or water freight station, or storage, team, loading or unloading track or private track, or wharf; provided that the handling of materials, products, or articles at such station, track, or wharf shall be subject to the same limitation and restrictions as apply to the district in which the station, track, or wharf is located;

Restaurant, laundry, theatre, dance hall, billiard room or bowling alley, if such restaurant, laundry, theatre, dance hall, billiard room or bowling alley is operated as a business for purposes of private profit;

Retail store, retail trade, vocation, profession, or shop for custom work or the making of articles to be sold at retail on the premises to the ultimate consumer, storage in warehouse of materials or products permitted as a C2 use; provided the operation of such store, trade, vocation, profession, shop, or storage does not involve the handling of materials, products, or articles across the public sidewalks in sufficient or considerable amounts so as to interfere with the free, safe, and continuous passage of pedestrians along such walks; and provided such store, trade, vocation, profession, shop, or storage does not involve the handling or trucking of materials, products, or articles, through the abutting or adjacent streets or alleys in sufficient quantities as to produce undue congestion in such streets and alleys or interfere with the usual functioning of those streets or alleys;

School for dancing except as hereinbefore classified, trade or vocational school other than an M use, horseback riding school;

Wholesale sales office or sample room;

Provided the operation of any such specified use is not offensive or noxious by reason of the emission of odors, fumes or gases, dust, smoke, noise or vibrations.

C2 Use—A C2 use shall include all uses not otherwise classified, provided all materials and products are stored and all manufacturing operations are carried on entirely within substantial buildings completely enclosed with walls and roof, and provided no operations are of such a nature as to become offensive or noxious to the occupants of adjoining residence or apartment uses by reason of the emission of odors, fumes or gases, dust, smoke, noise, or vibrations; and C2 uses shall include such uses as

Carpet cleaning, provided no dust is permitted to escape from the building;

Cigars, cigarettes, or smoking tobacco manufacturing;

Clay or glass products manufacturing, decorating, or assembling, provided no individual kiln capacity exceeds 200 cubic feet and no kiln is fired except by oil, gas, or electricity;

Cotton, wool, flax, hair, hemp, leather, felt, paper, cardboard, cork, rubber, fur, feathers, horn, bone, shell, celluloid, fiber articles or products manufacturing, or the manufacturing of articles or products from similar materials, but not including uses otherwise classified;

Felt manufacturing, provided no dust is permitted to escape from the building;

Ink manufacturing, not including the preparation of linseed or resin oils;

Lumber sawing, planing, dressing, shaping, pressing, turning, bending, carving, assembling, including carpenter shop for any kind of repairing or manufacturing except as otherwise classified whether or not the product is sold at retail on the premises;

Metal planing, shaping, bending, grinding, milling, drilling, die sinking, forging (except an M use), coring, punching, stamping, pressing, soldering, welding, riveting (other than snap riveting), buffing, polishing, or finishing, plating, galvanizing, sherardizing, tempering, annealing, hardening, other than by processes or operations which emit odor or noise of a disagreeable or annoying nature for the manufacturing of metal products; casting of aluminum, babbitt, brass, bronze, iron, lead, white metal for the manufacture of metal products, provided no metals are melted except in melting pot the capacity of which does not exceed 500 pounds or in electric furnace the capacity of which does not exceed 500 pounds, and further provided no pneumatic chippers are employed; assembling, not including an M2 or M3 use, of metal products or parts, or of metal assembled with other materials, except by processes or operations which emit noise of a disagreeable or annoying nature; sheet metal, tin, copper, brass workers' shop, plumbing shop, wagon shop, or machine shop, whether or not the product or service is sold at retail on the premises;

Painting, enameling, japanning, lacquering, oiling, staining, or varnishing shop, whether or not the product or service is sold at retail on the premises;

Pharmaceutical products, toilet preparations, patent or proprietary medicines, or baking powder manufacturing, provided no toxic or corrosive fumes, offensive odors or dust are permitted to escape from the building;

Rubber products manufacturing from Para, plantation or non-ill-smelling African rubbers in which sulphur chloride is not used;

Shoddy or shoddy felt manufacturing, provided no dust is permitted to escape from the building;

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Storage of such materials or products as acids, bark, broom corn, cotton, chemicals, clothing, drugs, dry goods, eggs, farm products, feed, food products, fruits furniture, glass, groceries, hardware, hemp, hops, household goods, ice, junk, jute, liquors machinery metals, millinery, naval or ship stores, paint, paper, pipes, plaster, produce, rags roofing materials, rice, rope, rubber, scenery, shop or mill supplies sugar, tobacco, textiles, vegetable fibre such as hemp, jute or others not specifically mentioned, waste paper, wines, wood; storage in underground tanks of oils, petroleum or inflammable fluids in quantities and under conditions permitted by other ordinances;

Wholesale produce salesroom or market;

Wholesale, packing, repacking, labeling, consigning or storage warehouse; also

Every use of manufacturing, assembling, repairing, packing, finishing, or storage, or any legal use not otherwise classified, if conducted wholly within a building generally occupied by more than one manufacturing use and customarily called a loft building, without serious annoyance or injury to other usual occupants of the same building and without affecting by reason of noxious odors, fumes or gases, or excessive dust, noise, vibration, or danger, a business or other use or activity which is customarily carried on or may be carried on wholly within the same loft building with the C2 use or which may be conducted on adjacent premises.

C3 Use—A C3 use shall include, provided all materials and products are stored and all manufacturing operations are carried on entirely within substantial buildings completely enclosed with walls and roof, and provided no operations are of such a nature as to become offensive or noxious to the occupants of adjoining premises devoted to or adapted for other uses, by reason of the emission of odors, fumes or gases, dust, smoke, noise, or vibrations, the following uses:

Brewery;

Cement products such as concrete blocks, pipe, garden furniture manufacturing;

Custom dyeing or cleaning, clothes cleaning, steam cleaning;

Distilled liquors or spirits manufacturing except an M use;

Feed manufacturing, except from refuse, offal or tankage;

Food products, beverages, confections manufacturing, preparation, compounding, baking, canning, packing, or bottling, including the grinding, cooking, roasting, preserving, drying, smoking, or curing of meats, fruits, or vegetables, except a C1 use or a use otherwise classified;

Fuel distributing station (except a C1 use) from which fuel is sold at retail and where all fuel is unloaded from carriers and loaded upon carriers and stored entirely within substantial enclosed buildings, provided the operation of said station is carried on without the emission of dust or noise;

Ice manufacturing for purposes of sale;

Milk or ice distributing station from which truck or wagon deliveries are customarily made;

Poultry killing, packing, or storage for purposes of sale at wholesale;

Paint or enamel blending, including all operations except operations which are M uses or other processes from which offensive or noxious odors, gases or fumes escape from the building;

Soap manufacturing from refined oils or fats, provided competent condensers or other appliances shall be operated where necessary to comply with the definition or the intended definition of a C3 use, and excepting the use of low grade greases, oils or tallow or other ingredients which emit noxious odors;

Stable for the housing of more than 8 horses or cows, livery or boarding or sales stable.

Section 9. **Auxiliary Uses in Commercial Districts.** (a) Auxiliary uses shall be permitted in a Commercial district. An auxiliary use to a C1 or C2 use shall not include a stable for the housing of more than 8 horses or cows or a livery or boarding stable.

(b) An auxiliary use in a Commercial district shall include an M1 storage use as hereinafter defined, provided such M1 storage use shall not occupy in excess of 50 per cent of that part of any premises wholly within a Commercial district, nor shall such M1 storage use be located nearer to a Residence or Apartment district than 50 feet, and further provided that such M1 use shall not be located nearer to a street upon which the C use abuts than 50 feet where a Manufacturing district does not adjoin the same street in the same block or in a block directly across the street from the C use, but an auxiliary M1 use shall in any case be permitted in that part of a Commercial district within 50 feet of a railroad right of way other than a street railway.

(c) An auxiliary use shall not include an M1 use other than storage, nor an M2 or M3 use as hereinafter defined.

Section 10. **C Use Limitation.** (a) A C1 use shall not include a C2 or C3 use. A C2 use shall not include a C3 use.

(b) No C2 use which is not auxiliary to and incidental to a C1 use, if such C2 use is located in that part of a Commercial district which is nearer at any point to a Residence or Apartment district than 125 feet, shall be operated between the hours of 8 P. M. and 6 A. M., if such operation involves the trucking or hauling of materials or products during such hours or if such operation involves processes of a nature such as to disturb the occupants of said Residence or Apartment districts between the hours of 8 P. M. and 6 A. M.

(c) No C2 use or part thereof, except a storage warehouse or more than one of such uses collectively or individually, together with auxiliary uses thereto, shall be established on more than one-half of the total floor space of a building located in that part of a Commercial district which is nearer than 125 feet at any point to a Residence or Apartment district, but floor space equal to the ground area of any premises in such part of a Commercial district may be occupied by C2 uses in any case although in excess of the said one-half; and such part of a Commercial district located within 135 feet of a railroad right of way other than a street railway, or located adjoining or across a street or across an alley from a Commercial district which is not restricted by the provisions of this paragraph or from a Manufacturing district, shall be exempt from the floor space restrictions of this paragraph. That portion of a building or premises wholly within such part of a Commercial district shall be deemed a separate building or separate premises for the purpose of determining the areas limited by the provisions of this paragraph.

(d) No C3 use or part thereof, together with auxiliary uses thereto, shall be established in that part of a Commercial district which is nearer at any point to a Residence district or Apartment district than 125 feet.

(e) No opening in the side or rear wall or roof of a public garage shall be nearer to the boundary line of a Residence or Apartment district than 16 feet.

Section 11. **Manufacturing Districts.** (a) In a Manufacturing district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be devoted to a use prohibited in the City of Chicago by any other ordinance. In a Manufacturing district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R, A, C, or M uses or special uses exclusively as hereinafter provided.

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(b) For the purpose of this ordinance, an M use is hereby defined as any use for an occupation, business or activity other than an R, A, or C use, that may lawfully be carried on within the city and shall include every lawful use except an R, A, or C, or special use. All M uses are further defined and classified as M1, M2, or M3 uses as follows:

M1 Use—An M1 use shall include such storage, manufacturing or other uses of property coming within the definition of an M use as do not injuriously affect the occupants of adjacent uses and are so operated that they do not emit dust, gas, smoke, noise, fumes, odors, or vibrations of a disagreeable or annoying nature.

An M1 storage use shall include such uses as

Above ground tanks for the storage of oils, petroleum or other inflammable fluids in quantities not greater than 3,000 cubic feet, except as prohibited or otherwise regulated by other ordinances;

Wholesale lumber yard, retail or mill lumber yard; wood yard; the storage in bulk or in yard or in shed of such products or materials as articles manufactured or in the process of manufacture (except as otherwise classified), asphalt, bark, barrels, boxes, brick, cement, cord wood, cotton, contractor's equipment, crates, creosoted products, gravel, iron, junk, lime, machinery, pipe, plaster, rags, roofing, sand, scrap iron, scrap paper, stone, tar, terra cotta, timber, vehicles; or the storage of any other products or materials which do not emit dust, gas or odors of a disagreeable or annoying nature.

An M1 use, provided such use does not customarily emit dust, gas, smoke, noise, fumes, odors, or vibrations which may be offensive or noxious to the adjacent R or A or C uses and does not injure the operation of adjacent C or M uses, shall include also every such use as

Bleaching and dyeing of yarns, textiles, or felt in case sulphur colors or materials which create offensive odors are not used;

Chalk, graphite, emery, corundum, carborundum, whiting, mercury salts, white lead, red lead, zinc salts, lithopone, plaster, pumice, or talc products manufacturing from the dry materials, or the manufacturing of products from other dust producing materials; provided no operation is contrary to the general definition of an M1 use;

Clay, glass, or shale products manufacturing except a C2 use, including the refining or blending of the raw materials;

Crematory except a crematory located in a cemetery;

Fabricating, other than snap riveting or processes used in bending and shaping of metal which emit noises of a disagreeable or annoying nature, for assembling metal products; forging of metals, melting, casting of metals or manufacturing of steel or alloys of steel from iron, provided no cupola is employed; and further provided no operation is contrary to the general definition of an M1 use;

Paper or strawboard manufacturing from waste paper stock or pulp board;

Railroad freight, storage or classification yard; railroad shop or roundhouse;

Stone, marble or granite grinding, dressing, or cutting; provided no operation is contrary to the general definition of an M1 use;

Varnish or enamel manufacturing from balsam gums, copal, or spar and turpentine, alcohol or benzine and other ingredients which do not emit disagreeable or noxious fumes or gases;

Or any use not otherwise classified which is not contrary to the general definition of an M1 use and not contrary to the classification of such uses herein made.

M2 Use—An M2 use shall include the uses set forth hereunder, provided such use does not customarily emit dust which is not controlled by competent dust collecting appliances, or such use is one which from the nature of the materials handled or processes customarily employed, emits dust, gas, smoke, noise, fumes, or odors, to such an extent as to affect the health, safety, comfort, morals or welfare of occupants of R or A or C uses located not farther than 400 feet from the M2 use, and which use does not customarily emit corrosive or tarnishing gases or fumes which injure C or M uses distant 100 feet or more from the M2 use, or which does not create vibrations to an extent that would damage buildings or affect the position or alignment of machinery erected with usual permanency on premises distant 100 feet or more from the M2 use; in which classification, subject to the conditions named, is every such use as

Bone grinding from soft bone;

Carpet beating or cleaning;

Chalk, graphite, emery, corundum, carborundum, whiting, mercury salts, white lead, red lead, zinc salts, lithopone, plaster, pumice or talc products manufacturing from the dry materials, or the manufacturing of products from other dust producing materials;

Chewing tobacco or snuff manufacturing;

Coffee roasting or manufacturing of coffee substitutes where roasting of cereals is done;

Dyes manufacturing from coal tar derivatives;

Emery, corundum or carborundum, graphite products manufacturing by the employment of grinding processes;

Foundry compound or parting sand manufacturing;

Fuel gas or illuminating gas manufacture or purification;

Fuel gas or illuminating gas storage or the storage above ground of other inflammable fluids except as otherwise classified;

Fuel pocket, tipple, trestle, dump or yard, wholesale or retail, other than a C3 use;

Grain elevator;

Grease, lard, fat, or tallow rendering or refining, except from refuse or rancid fats;

Linseed oil, or similar oils, manufacturing, boiling, or refining;

Lithopone manufacturing;

Live stock corrals or pens, stock yards;

Metal fabricating processes or the assembling of materials where snap riveting is done, or where processes creating noises permitted in the general definition of an M2 use are carried on, for the manufacturing of such products as locomotive or power plant boilers or similar boilers; cranes, dredges, derricks, excavating buckets, locomotives, railroad and electric cars, ships, steel and wood cars, steel truck bodies; structural and reinforcing steel for buildings, bridges, ships and other structures; wire fence, wire lath and reinforcing wire; forging, melting, heating or casting of metals or their alloys, employing all processes, except a use otherwise classified, for the manufacturing of such products as armor plate, automobile or wagon springs, brake shoes, cast iron pipe, cast iron safes, drop forgings, furnaces, ingot-molds, iron or steel billets, plates, sheets, structural shapes, rails, tubes, molding machinery, railroad car wheels, axles, or springs;

Nail, tack or rivet manufacturing where heading or cutting machines are employed;

Operation of internal combustion engines without competent muffling devices;

Paper manufacturing, except as otherwise classified;

Planing mill;

Plaster or plaster of Paris manufacturing;

Pumice stone grinding or refining;

Rubber products manufacturing from Para, plantation or non-ill-smelling African rubbers, in which sulphur chloride is used;

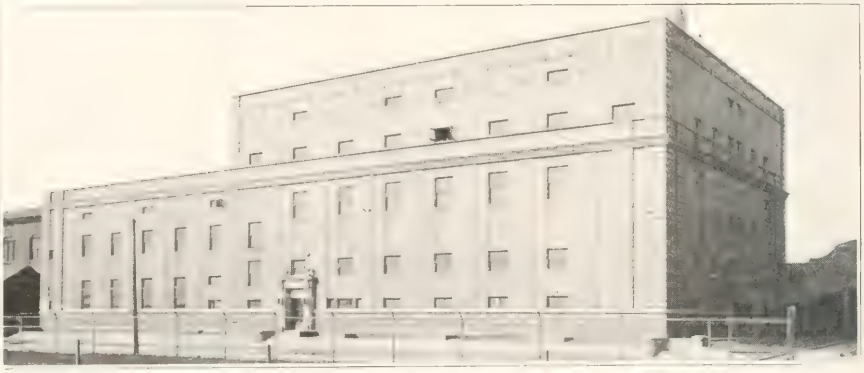
Sausage casings, gut strings or similar products manufacturing;

Sewage purification by Imhoff, activated sludge or similar processes;

Shellac refining;

Slaughtering;

Shoddy or shoddy felt manufacturing;



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Soap manufacturing, except a use otherwise classified;
Soya bean oil, or china wood oil manufacturing or refining;
Stone crushing and screening; stone grinding, cutting or buffing not otherwise classified; stone quarry;
Varnish or enamel manufacturing if animal glues or shellac are used as ingredients of the varnish or enamel;
Vinegar or yeast manufacturing;
White lead or red lead manufacturing; whiting manufacturing;
Or any use not otherwise classified or which is not contrary to the general character of M2 uses as indicated by the classification herein contained and the conditions imposed.

M3 Use—An M3 use shall include all M uses which are excluded from the M1 and M2 classification; including every such use as:
Animal black, bone black or lamp black manufacturing;
Asphalt manufacturing or refining; asphalt or similar preservative coating or impregnation of fibre materials or wood where heat is applied;
Cattle or sheep dip manufacturing;
Chlorine or bleaching powder manufacturing; electrolysis of brine;
Coal distillation, including derivation of such products as gas, ammonia, or coal tar;
Coal tar, refuse grain, fermented refuse grain, bones or wood distillation;
Cottonseed oil, or similar oils, manufacturing, boiling or refining;
Creosote manufacturing or refining;
Dyeing of yarn, textiles, or felt, except a use otherwise classified;
Fertilizer manufacturing from organic matter or minerals;
Fish curing, cooking, smoking or canning; fish oil manufacturing or refining;
Glue, size or gelatine manufacturing, where the processes include the refining or recovery of products from fish or animal refuse or offal;
Grain drying or poultry feed manufacturing from refuse mash from breweries or from refuse grain;
Gypsum refining;
Hydrochloric, nitric, sulphuric, or sulphurous acid manufacturing;
Incineration, drying, or reduction or storage, of garbage, offal, refuse, dead animals or other refuse;
Lime kiln;
Ore or slag pile or dock;
Petroleum or kerosene refining or distillation or derivation of by-products;
Portland, slag, or natural cement manufacturing;
Rubber products manufacturing from or the refining of ill-smelling African or similar rubbers;
Slaughter house refuse, or other refuse, or rancid fats, or refuse dead animals, cooking, boiling, or rendering;
Smelting or refining of such metals or their alloys as aluminum, iron, lead, steel, tin, zinc, from the ores;
Starch, dextrine, or glucose manufacturing; sugar refining;
Tanning of hides or pelts, also storage, curing or cleaning of raw hides or pelts;
Wool scouring, washing of hair from tanneries, or from slaughter houses; washing of feathers or similar operations;
Or any other use that is lawful within the city, which would be harmful by reason of dust, gas, smoke, noise, fumes, odors, vibrations, soot, sudden fire or explosion or any other causes to a use otherwise classified at a distance of 2,000 feet or more from the M3 use; provided the uses set forth hereunder are not contrary to the provisions of any other ordinance of the City of Chicago.

Section 12. **M Use Limitations.** (a) An M1 use shall not include an M2 or M3 use and shall not be classified as an M1 use if such M2 or M3 use is present; an M2 use likewise shall not include an M3 use.

(b) No M2 use shall be established nearer to a Residence or Apartment district than 400 feet nor nearer to a Commercial district than 125 feet.

(c) An M3 use shall not be established nearer to a Residence, Apartment or Commercial district than a distance at which the M3 use would not from any cause be offensive or noxious to the occupants of such Residence, Apartment or Commercial district, but the distance of an M3 use from a Commercial district shall not be less than 500 feet nor shall the distance from a Residence or Apartment district be in any case less than 2,000 feet.

Section 13. **Special Uses.** (a) For the purposes of this ordinance all special uses are classified as follows:
Airdrome;
Street car barn;
Cemetery;
Circus, carnival, carousal, open air, or tent show or similar use, operated for purposes of private profit;
Hospital or sanitarium for the care of contagious diseases or incurable patients;
Institution for the care of the insane or feeble-minded;
Penal or correctional institution;
Police or fire station;
Public service water reservoir, filtration plant, or pumping station;
Public service or institutional light, heat or power plant except auxiliary use;
Public utility gas plant, electric station or substation;
Telephone exchange.

(b) A special use or the extension of an existing special use may be located in any district without restriction as to the distance from any other district, provided such location or such extension will not seriously injure the appropriate use of neighboring property.

Section 14. **Non-conforming Uses.** (a) A non-conforming use existing at the time of the passage of this ordinance may be continued.

(b) A non-conforming use shall not be extended, but the extension of a use to any portion of a building which was arranged or designed for such non-conforming use at the time of the passage of this ordinance shall not be deemed the extension of a non-conforming use.

(c) A building other than an A3 use arranged, designed or devoted to a non-conforming use at the time of the passage of this ordinance may not be reconstructed or structurally altered to an extent exceeding in aggregate cost, during any ten-year period, 50 per cent of the value of the building unless the use of such building is changed to a conforming use.

(d) A non-conforming A3 use may be enlarged or extended within the limitations of the volume district in which it is located.

(e) A non-conforming yard storage use shall not be expanded in area of storage space so used.

(f) A non-conforming advertising sign use if removed from the premises may not be replaced.

(g) A non-conforming use shall not be changed unless changed to a more restricted use; provided, however, that in a Residence district an M use shall not be changed unless changed to a conforming use.

(h) A non-conforming use if changed to conforming use shall not thereafter be changed back to any non-conforming use.

(i) A non-conforming use if changed to a more restricted non-conforming use shall not thereafter be changed unless to a still more restricted use.

(j) In a Residence district an A1 use shall not be changed to an A2 use.

(k) In a Manufacturing district no existing M use shall be deemed to be non-conforming except where such use is nearer at the time of the passage of this ordinance to a Residence or Apartment or Commercial dis-

LOGAN SQUARE MASONIC TEMPLE — [illegible], Architect

H. F. FRIESTEDT, *President* — C. W. HAYNES, *Vice-President*

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...ter, as the case may be, than the minimum distance as prescribed by this ordinance.

(f) For the purposes of this ordinance a use shall be deemed to be changed if changed from a use included in a use class to a use not included in such class.

(g) A non-conforming use except as hereinbefore provided shall be deemed to be changed to a more restricted use if the use to which such non-conforming use is changed is a use included in a use class that in the arrangement of classes precedes the class in which such non-conforming use is included. The classes shall be deemed to be arranged in order of precedence as R, A, C1, C2, C3, M1, M2 and M3, as hereinbefore defined.

Section 14A. It shall be unlawful for any person, firm or corporation to carry on or engage in the business of keeping a junk store or a junk yard upon any street in the city upon which is located a street railway line.

Section 15. **Size of Building.** For the purpose of regulating and limiting the height and bulk of buildings hereafter to be erected, of regulating and limiting the intensity of the use of lot areas, and of regulating and determining the area of open spaces within and surrounding such buildings, the City of Chicago is hereby divided into five classes of districts: 1st Volume district, 2nd Volume district, 3rd Volume district, 4th Volume district and 5th Volume district, as shown on the volume district map which accompanies this ordinance, such volume district map being referred to in Section 3, and by said Section 3 made a part of this ordinance. The volume districts designated on said map are hereby established. No building or part of a building shall be erected except in conformity with the regulations herein prescribed for the volume district in which said building is located. No lot area shall be so reduced or diminished nor shall a building be so enlarged that the volume of the building shall be greater or the open spaces shall be smaller than hereinafter prescribed. The open spaces required for a particular building shall not be included as a part of the required lot or yard areas of any other building.

Section 16. **1st Volume District.** In a 1st Volume district (except as provided by Section 21 of this ordinance):

(a) No building, except a building in a Commercial or Manufacturing district, shall occupy more than 50 per cent of the area of a lot if an interior lot or 65 per cent if a corner lot, exclusive of the area hereinbefore provided for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the volume of certain attic spaces or spaces above the ceiling level of the story next below the roof and exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 10 feet where the lot is not a corner lot, or by 13 feet in the case of a corner lot, or by 36 feet in a Commercial or Manufacturing district; provided that 2 10 feet but not more than a total of 2 feet in any case shall be added to the 10 feet or to the 13 feet for each 100 square feet that the lot of record prior to the date of the passage of this ordinance in a Residence or Apartment district is less in area than 3,600 square feet. Attic space, space above the ceiling level of the story next below the roof of a building or any part of a building, space above the enclosing walls of a church or auditorium or room or that part thereof contained wholly within the roof space above the level of the enclosing wall or walls, may be enclosed in addition to the volume of a building, provided the cubic content of such space or room or such part thereof is not in excess of the cubic content of the space which would be enclosed by a hip roof making angles of 60 degrees with the horizontal springing from a horizontal plane on the enclosing walls or part thereof of such building, church, or auditorium.

(b) At any street line no building or part thereof shall exceed a height of 66 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 1 foot in height in excess of 33 feet. No part of a building shall be erected to a height at any point in excess of 66 feet.

(c) For each 1 foot that a building or portion of it is distant from the center line of an alley, such building or such portion thereof may be erected 1 foot in height. No building or portion thereof shall be erected nearer the center line of an alley than 8 feet.

(d) For each 1 foot that a building or portion of it sets back from all lines of adjacent premises, such building or such portion thereof may be erected 1 foot in height in excess of 30 feet, provided that along lines of adjacent premises in a 2nd Volume district the setback regulation required along lines of adjacent premises in a 2nd Volume district shall apply, and further provided that along the lines of adjacent premises in a 3rd or 4th or 5th Volume district no setback shall be required. For the purpose of this paragraph the height of a building shall be the mean level of the top of a parapet wall or the mean level of the top of the structure. Chimneys are exempt from the provisions of this paragraph.

Section 17. **2nd Volume District.** In a 2nd volume district (except as provided by Section 21 of this ordinance):

(a) Located within a Residence or Apartment district no building shall occupy more than 60 per cent of the area of a lot if an interior lot or 75 per cent if a corner lot, exclusive of the area hereinbefore provided for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 40 feet and by 52 feet in the case of a corner lot, except that 1 per cent but not more than a total of 5 per cent shall be added to the 60 per cent or 75 per cent respectively for each 100 square feet that the lot of record prior to the date of the passage of this ordinance is less in area than 3,600 square feet.

(b) Located within a Commercial or Manufacturing district the aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 72 feet.

(c) At any street line no building or any part thereof shall exceed a height of 66 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or portion thereof may be erected 2 feet in height in excess of 66 feet. No part of a building shall be erected to a height at any point in excess of 132 feet.

(d) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 5 feet in height and no building or portion thereof shall be erected nearer to the center line of an alley than 8 feet; provided these regulations shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects.

(e) Located within a Residence or Apartment district for each 1 foot that a building or portion of it sets back from any line of adjacent premises such building or such portion thereof may be erected 2 feet in height in excess of 30 feet; provided that along lines of adjacent premises in a 2nd or 3rd or 4th or 5th Volume district, this setback regulation shall not be required. Chimneys are exempt from the provisions of this paragraph.

Section 18. **3rd Volume District.** In a 3rd Volume district (except as provided by Section 21 of this ordinance):

(a) Located within a Residence or Apartment district no building shall occupy more than 75 per cent of the area of a lot if an interior lot or 90 per cent if a corner lot, exclusive of the area hereinbefore provided

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for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 100 feet, or by 120 feet in the case of a corner lot;

(b) Located within a Commercial or Manufacturing district the aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 144 feet;

(c) At any street line no building or part thereof shall exceed a height of 132 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 2 feet in height in excess of 132 feet. No part of a building shall be erected to a height at any point in excess of 198 feet;

(d) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 7 feet in height and no building or portion thereof shall be erected nearer to the center line of an alley than 8 feet, provided these regulations shall not be applied along that part of an alley for the 55 feet of its length nearest the established building line on the street which the alley intersects.

Section 19. **4th Volume District.** In a 4th Volume district (except as provided by Section 21 of this ordinance):

(a) The aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 216 feet, or by 240 feet in the case of a corner lot which is located also in a Residence or Apartment district; in a Residence or Apartment district the area provisions of Section 18, paragraph (a) shall apply;

(b) At any street line no building or part thereof shall exceed a height of 198 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 3 feet in height in excess of 198 feet. No part of a building shall be erected to a height in excess of 264 feet;

(c) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 9 feet in height, provided this regulation shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects;

Section 20. **5th Volume District.** In a 5th Volume district (except as provided by Section 21 of this ordinance):

(a) No building or part thereof shall be erected to a height at any street line or alley line in excess of 264 feet, provided, however, that back from the street line or alley line such building or part thereof may be erected so as not to protrude above a plane sloping up at an angle of 30 degrees with the horizontal from such street line or alley line at the height limit a distance from such street line or alley line of 32 feet measured on the slope. The height of such sloping plane shall be the ultimate height of the structure. In a Residence district or Apartment district the area provisions of Section 18, paragraph (a) shall apply;

(b) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 10 feet in height, provided this regulation shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects.

Section 21. **General Volume District Provisions.** (a) Where all parts of a cornice of any building or structure are more than 12 feet above the grade as defined in Section 2, paragraph (1) and below a height of 120 feet in a 3rd Volume district or below 186 feet in a 4th Volume district or below 252 feet in a 5th Volume district, and where such cornice extends in whole or in part along the street frontage of a building and where the return of such cornice, if any, along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street a distance of 5 feet and into the alley a distance of 3 feet, but for each 1 foot above the height of 120 feet or 186 feet or 252 feet in the 3rd or 4th or 5th Volume districts respectively, the projection of the cornice shall be reduced 3 per cent of the prescribed 5 feet or 3 feet until a projection of 2 feet shall have been reached. Above the height of a parapet as provided for by paragraph (b) of this section, no part of a structure shall project into a street or alley a greater distance than 2 feet.

(b) Nothing in this ordinance shall prevent the erection above the street line height limit of such structural members as are required to support the roof, or a parapet wall or cornice solely for ornament and without windows, extending above such height limit not more than 5 per cent of such height, but such parapet wall or cornice may in any case be at least 5½ feet high but shall not be higher than 8 feet above such height limit.

(c) Nothing in this ordinance shall prevent the erection in a Manufacturing or Commercial district, above the height and in excess of the volume as provided by this ordinance of grain elevators, conveyors, derricks, gas holders, or other necessary appurtenances to manufacturing or storage operations in connection therewith.

(d) In a 1st or 2nd Volume district which is also in a Commercial or Manufacturing district, or in a 3rd, 4th or 5th Volume district; if the area of a building is reduced so that above the street line height limit it covers in the aggregate not more than 25 per cent of the area of the premises, the building above such height shall be excepted from the volume and street line height limit regulations. The aggregate volume in cubic feet of all such portions of the building shall not exceed one-sixth of the volume of the building as permitted by this ordinance on the premises upon which such portions are erected; provided that for each 1 per cent of the width of the lot on the street line that the street wall above the street line height limit is greater in length than 50 per cent of the width of the lot, such wall shall be erected not nearer to such street line than 1 foot; and further provided that for each 10 feet in height that any such portion of the building is erected above the street line height limit, such portion of the building shall be set back 1 foot from all lines of adjacent premises. For purposes of this paragraph, the permitted volume of a building in the 5th Volume district shall be the cubic contents of the space which may be occupied under the provisions of Section 20 of this ordinance.

(e) The street line height limit in a 2nd, 3rd, or 4th Volume district shall be increased 33-1/3 per cent of such height limit on that frontage of premises which abuts on a street greater in width than 120 feet, or on that frontage of premises directly across the street from a public park, public playground, public waterway, or cemetery, or railroad right of way other than a street railway. The same increase in the street line height limit shall apply to the frontage on a street which intersects or intercepts such street or park or playground or waterway or cemetery or railroad right of way for a distance from such street or park or playground or waterway or cemetery or railroad right of way equal to the depth of the lot under one ownership at the time of the passage of this ordinance but not beyond the boundary of the volume district which that part of the frontage of the lot is in (1) which abuts on a street greater in width than 120 feet, or (2) which is directly across the street from such park, playground, waterway, cemetery, or right of way, in any case. But the provisions of this paragraph shall not be so construed as to increase the ultimate height

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limit or the volume limit as provided by this ordinance.

(f) In a 3rd, 4th or 5th Volume district which is also in an Apartment district, the entire ground area of the lot up to an ultimate height of 30 feet may be occupied, provided such space shall be used only as a waiting room, lobby, or lounging room or auditorium or service rooms, auxiliary to an R2 or A use, and further provided that the volume as permitted by this ordinance shall not be increased and further provided that the provisions of Section 22 shall take precedence over all provisions of this paragraph.

(g) Nothing in this ordinance shall prevent the erection above the street line height limit, of spires in connection with an R2 use.

(h) Where premises in one volume district are directly across an alley from a less restricted volume district, all the regulations prescribed by this ordinance pertaining to the distance of a building or part thereof from the center line of an alley for that less restricted district shall be applied to such premises.

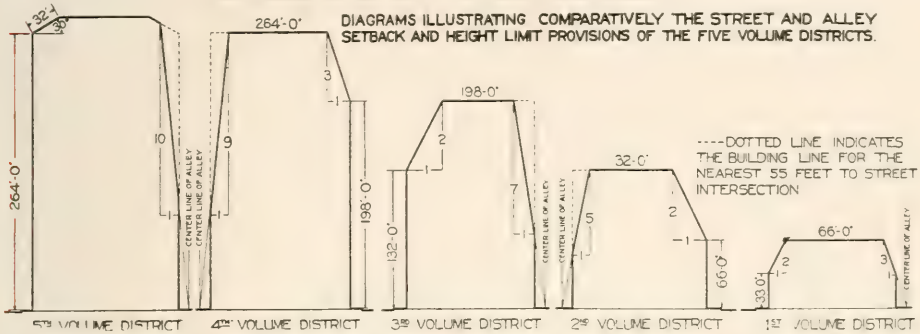
(i) Where premises or any portion thereof abut on an alley which also adjoins a railroad right of way, public park, playground or cemetery, or which abut on the end of what is commonly known as a blind alley, the provisions pertaining to distance of a building or part thereof from the center line of an alley shall not apply for such premises or such portion thereof.

(j) A fire escape as required by other ordinances of the City of Chicago, fire-proof outside stairway or solid floor balcony to a fire tower if projected not more than 4 feet into a court or yard, the ordinary projections of window sills, belt courses, if such projections do not exceed 6 inches, shall not be deemed to reduce the area or volume of open spaces. Cornices or similar ornamental features projecting not over 4 feet into courts, which open on a street or alley shall not be deemed to reduce the area or volume of open spaces for the purpose of determining the volume of a building.

(k) Where a lot greater in area than 8,000 square feet, located in a Residence or Apartment district abuts on two intersecting streets at their intersection, the area and volume of the building as permitted by this ordinance may be distributed over the lot.

(l) The provisions of Section 22 shall take precedence over the area provisions of all Volume district sections of this ordinance.

THESE DIAGRAMS ARE NOT PART OF THE CHICAGO ZONING ORDINANCE.



Volume Districts	Use Districts	Lot	Occupancy of lot in per cent of lot area	Volume of building, area of lot times	1 ft. setback from side lot lines for each 3 ft. above	Height limit at street line in feet	1 ft. setback from street line above height limit for added height of	1 ft. setback from center line of alley at grade for height of	Ultimate height of building in feet	No building nearer the center line of alley than
1st	Res. or Apt. Res. or Apt. Com. or Mfg.	Interior Corner	50 65 100	10 (D) 13 (D) 36 (D)	30 ft. (G)	33 (F)	2 ft.	3 ft	66 (K)	8 ft.
2nd	Res. or Apt Res. or Apt Com. or Mfg.	Interior Corner	60 (B) 75 (B) 100	40 50 72	44 ft. (G) None	66 (F)	2 ft	5 ft. (L)	132 (K	8 ft M
3rd	Res. or Apt. Res or Apt Com. or Mfg.	Interior Corner	75 90 100	100 120 144	None	132 (F)	2 ft.	7 ft. (L)	198 (K)	8 ft M)
4th			100	216	None	198 (F)	3 ft.	9 ft. (L)	264 (K)	
5th			100	No Volume Provision	None	264	(H)	10 ft. (L)	(H) (K)	

NOTES.

(Not a part of the ordinance.)

A—Corner lot maximum area 8,000 square feet.

B—1% (maximum 5%) may be added to the 60% or 75% of the area in a 2nd Volume Residence or Apartment district for each 100 square feet that the lot is less in area than 3,600 square feet.

C—Private or community garage 1 story not included in area or volume limits in 1st, 2nd or 3rd Volume Residence or Apartment districts.

D—Volume of a building includes courts not open to a street or alley; in a 1st Volume district space under a pitched roof (equal in volume to a 60 degree hip roof) may be erected in addition to Volume; 2/10 foot (maximum 2 feet) may be added to Volume factors of 10 feet and 13 feet in a 1st Volume Residence or Apartment district for each 100 square feet that the lot is in area than 3,600 square feet.

E—Height limit at street line is to under side of ceiling beams; parapet (maximum height 8 feet) may be added.

St. Ita's Church, Chicago — H. J. Schlacks, Architect

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F—Street line height limit may be relaxed where frontage is on a public space.

G—Side lot line set back height limit is to the mean level of the top of fire wall; at a district boundary the least restrictive rule applies.

H—In a 5th Volume district the slope up from the street and alley lines above 264 feet is 30 degrees, for a distance of 32 feet up the slope.

I—Cornices with 5 feet projection are permitted (3 feet projection in an alley back from the street a distance equal to the width of the alley) to a height 20 feet below the height limit of the parapet; for each 1 foot above that height the cornices are reduced in projection 3%.

J—Grain elevators, derricks, gas tanks, etc., are allowed above height limit in a 1st, 2nd or 3rd Volume manufacturing use.

K—Towers in 1st and 2nd Volume commercial or manufacturing districts and in 3rd, 4th or 5th Volume districts. (See paragraph (d) Section 21.)

L—Alley set back in a 2nd, 3rd, 4th or 5th Volume district does not apply for nearest 55 feet to the street which the alley intersects.

M—Distance of buildings from center line of alleys in a 2nd or 3rd Volume district does not apply for nearest 55 feet to the street which the alley intersects.

Section 22. **Building Lines.** (a) For the purpose of preventing the obstruction to light and air for adjoining premises in Residence and Apartment districts by establishing building lines along the street frontage, no building shall be erected or altered in a Residence or Apartment district which is also in a 1st, 2nd or 3rd volume district or as provided by paragraph (e) of this section in a Commercial district, except in such a manner as to conform to the provisions of this section.

(b) In a Residence district no building shall be erected whose street wall is nearer the front street line than a distance equal to 15 per cent of the average depth of the lots in a block except as hereinafter provided. In an Apartment district no building shall be erected whose street wall is nearer to the front street line than a distance equal to 10 per cent of the average depth of the lots in a block except as hereinafter provided.

(c) Where a block is occupied or partially occupied by buildings which existed in the block at the time of the passage of this ordinance, the average of the distances from the street line of the front street walls of buildings shall be the established building line; but where this average distance does not exceed 10 feet in a block in which the street wall of any existing building is nearer along the front line to the street than 5 feet the street wall may be erected at the street line. Lots occupied by buildings designed for residence uses permitted in a Residence district, unless the aggregate frontage of such lots exceeds 50 per cent of the total frontage in the block, shall be considered as though vacant where located in an Apartment district for the purpose of establishing the building line.

(d) For the purpose of computing the average of the distances of street walls of buildings from the street line, the street wall nearest the street shall be considered as though it were continuous across the entire lot frontage and such average shall be based upon units of lot frontage, but buildings whose street walls are distant from the street line in excess of the provisions of paragraph (b) of this section shall be deemed to exactly conform to the provisions of paragraph (b), and existing auxiliary buildings, temporary buildings, fences, advertising signs, retaining walls, steps, balustrades, or similar existing structures shall not be considered in computing such average.

(e) Along the side of a corner lot in a Residence district or Apartment district which is not known as the front line and which generally is the side having the greatest dimension along a street line and which side line is in the same block with a lot or lots whose street line is the front line, no building shall be erected whose street wall is nearer the street at the rear end of such line than the established building line in the block and for each 1 foot that the building or part thereof is distant from the adjoining lot line exclusive of the width of an intervening alley, if any, such building or such part thereof may be erected 1 foot nearer to the street line. The provisions of this paragraph shall apply to a Commercial district which is also in a 1st or 2nd Volume district and which is in the same block with a Residence district or Apartment district.

(f) Where a lot adjoins premises, the street wall line of which is unrestricted or less restricted by this section, the street wall line of such lot for that 75 per cent of the lot frontage nearest to such unrestricted or less restricted street wall line but not in excess of 30 feet in any case, may conform to the provisions of this section as they apply to such unrestricted or less restricted street wall which it adjoins.

(g) Where any existing building erected prior to the time of the passage of this ordinance has its street wall nearer to the street line than the building line as established by this section, then the street wall of any building erected or altered on that 75 per cent of the frontage not in excess of 30 feet of the adjacent lot which immediately adjoins the lot occupied by such existing building may approach not nearer the street line than the street wall of such existing building.

(h) Cornices, belt courses, an entrance canopy or similar roofed space having not more than 20 square feet of horizontal area covered by roof for each 25 feet of lot frontage, porches or bays projecting not more than 3 feet 6 inches exclusive of cornice and having an aggregate volume at any story not in excess of 35 per cent of the area of that part of the street wall of a building at such story multiplied by 3½ feet, and steps and landings below the level of the first floor, and their balustrades and open fences or railings or similar structures hereafter erected, provided such fences or railings or structures do not obstruct vision to an extent in excess of 40 per cent above a height of 4 feet 6 inches above the established grade, shall be exempt from the restrictions provided by this section.

(i) The premises of each building, with its usual auxiliary buildings, existing at the time of the passage of this ordinance, or premises or part thereof which may hereafter be occupied by buildings, or additions to existing buildings, shall be deemed a lot for the purposes of this section. Lots separated by an alley shall be deemed to be adjoining. All measured distances shall be to the nearest integral foot. If the fraction is ½ foot or less the integral foot next below shall be taken.

Section 23. **District Boundaries.** (a) Whenever a portion of any district is indicated upon the use or volume district map as a strip paralleling an opened or unopened street, the width of this strip, unless delimited on the map by dimensions, lot lines, alleys, railroad or elevated railway rights of way, or otherwise, shall be assumed to be 125 feet measured at right angles from the nearest street line of the street to which it is parallel and adjacent.

(b) The district boundaries are, unless otherwise indicated, either street lines or lines drawn parallel to and 125 feet back from one or more of the street lines bounding a block. Where two or more district designations are shown within a block 250 feet or less in width the boundary of the less restricted district shall be deemed 125 feet

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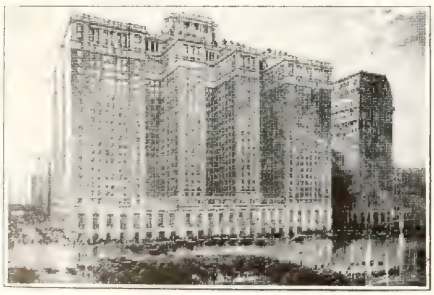

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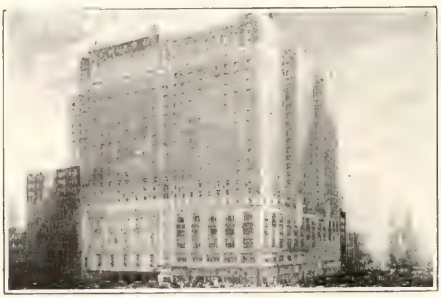

Palmer House

back from its street line. Where two or more district designations are shown within a block more than 250 feet in width the boundary of the more restricted district shall be deemed 125 feet back from its street line.

(c) Where the street layout actually on the ground varies from the street layout as shown on the use or volume district map, the designation shown on the mapped street shall be applied to the unmapped streets in such a way as to carry out the manifest intent and purpose of the plan for the particular section in question.

(d) Where a district boundary line as defined in this section or as shown on the use or volume district map divides a lot in single ownership at the time of the passage of this ordinance, the use or volume authorized on the least restricted portion of such lot shall be construed as extending to the entire lot, provided this does not extend more than 25 feet beyond the said boundary line of the district in which such use is authorized. The use or volume so extended shall be deemed to be conforming.

(e) The space above the surface of streets, alleys or waterways are to be regarded merely as explanatory of the maps and shall not be deemed to be a part of the use district to which it is adjacent.

(f) Submerged lands which may hereafter be reclaimed, unless otherwise indicated on the use or volume district maps, shall be deemed to be in the same use and volume district as premises not now submerged to which such submerged lands are contiguous.

(g) Areas on the use and volume district maps along the margin of such maps outside of the border line streets are to be regarded merely as explanatory of the maps and shall not be considered as indicating the use or volume indicated thereon.

Section 24. **Completion and Restoration of Existing Buildings.** Nothing herein contained shall require any change in the plans, construction or intended use of a building for which a building permit has been heretofore issued and the construction of which shall have been diligently prosecuted within one year of the date of such permit, and the ground story of which, including the second tier of beams shall have been completed within such year, and which entire building shall be completed according to such plans as filed within three years from the date of the passage of this ordinance; provided the time shall be extended for not to exceed one year, or in cases where one such extension may have been granted the time shall be further extended for one year within which such ground story framework, including the second tier of beams shall be completed in any case where actual construction or fabrication was begun early enough to allow, under the then existing conditions, adequate time for completion as above specified and where such construction or fabrication was diligently prosecuted and where such completion has been prevented by conditions impossible to foresee and beyond the control of the owner or builder. Nothing in this ordinance shall prevent the restoration of a building or an advertising sign destroyed by fire, explosion, act of God or act of the public enemy, not in excess of 50 per cent of the value of the building, or prevent the continuance of the use of such building or part thereof as such use existed at the time of such destruction of such building or part thereof or prevent a change of such existing use under the limitations as hereinbefore provided.

Section 25. **Administration.** This ordinance shall be enforced by the Commissioner of Buildings. The Commissioner of Buildings is hereby empowered and it shall be his duty to administer this ordinance in conjunction with the administration of such portions of the general ordinances of the City of Chicago as are commonly designated as the building code of the City of Chicago in such a manner as to facilitate their joint administration. For the purpose of enforcing this ordinance the authority vested in him under the said building code is hereby declared to be vested in him under this ordinance.

Section 26. **Certificates of Occupancy.** (a) It shall be unlawful to use or permit the use of any building or premises or part thereof, hereafter created, erected, changed or converted wholly or partly in its use or structure, until a certificate of occupancy, to the effect that the building or premises or the part thereof so created, erected, changed or converted, and the proposed use thereof, conform to the provisions of this ordinance, shall have been issued by the Commissioner of Buildings. No change or extension of use and no alterations shall be made in a nonconforming use or premises without a certificate of occupancy having first been issued by the Commissioner of Buildings that such change, extension or alteration is in conformity with the provisions of this ordinance.

(b) Certificates of occupancy shall be applied for at the same time that the building permit is applied for and shall be issued within 10 days after the erection or alteration of the building shall have been completed. A record of all certificates shall be kept on file in the office of the Commissioner of Buildings and copies shall be furnished upon request to any persons having a proprietary or tenancy interest in the building affected.

(c) Pending the issuance of a regular certificate, a temporary certificate of occupancy may be issued for a period not exceeding six months, during the completion of alterations or during partial occupancy of a building pending its completion. Such temporary certificates shall not be construed as in any way altering the respective rights, duties or obligations of the owners or of the city relating to the use or occupation of the premises or any other matter covered by this ordinance, and such temporary certificate shall not be issued except under such restrictions and provisions as will adequately insure the safety of the occupants. No temporary certificate shall be issued if prior to its completion the building fails to conform to the provisions of the building code or of this ordinance to such a degree as to render it unsafe for the occupancy proposed.

Section 27. **Plats.** Each application for a build permit shall be accompanied by a plat in duplicate, drawn to scale and in such form as may be prescribed by the Commissioner of Buildings, showing the actual dimensions of the lot to be built upon, the size of the building to be erected, and such other information as may be necessary to provide for the enforcement of the regulations contained in this ordinance. A careful record of such applications and plats shall be kept in the office of the Commissioner of Buildings.

Section 28. **Board of Appeals.** A board of appeals is hereby established. The members of the board of appeals shall be appointed by the Mayor, subject to confirmation of the City Council. The board of appeals shall consist of five members. One of said members shall be an architect who has had 10 years' experience in the practice of his profession, one shall be a structural engineer who has had 10 years' experience in the practice of his profession, another shall have had 10 years experience as a builder, and still another shall have had 10 years' experience as a real estate dealer. The chairman shall be designated by the Mayor. The board of appeals shall keep minutes of its proceedings showing the vote of each member on every question, or if absent or failing to vote indicating such fact. The board of appeals in its rules shall fix the time for regular meetings of the board. Special meetings may be called by the chairman or at the request of two members, provided that notice of the same shall be mailed to each member at least 24 hours before the time set, except that the announcement of a special meeting at any meeting at which all members are present shall be sufficient notice of such meeting. All meetings shall be open to the public. A quorum of the

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board of appeals shall consist of three members. A majority of the members present at each meeting shall control its official actions. The members of the board shall attend meetings in person.

Note—By an amendment to the Enabling Act August 8, 1924, (Smith-Hurd, Illinois Revised Statutes, 1923, Chapter 24, Zoning) enacted since the passage of the zoning ordinance, the Board of Appeals is given power to grant variations without action by the City Council. The same amendment provides also that Council may pass amendments to the zoning ordinance without the approval of the Board of Appeals.

The provisions of the revised statute take precedent over Section 29 of the Zoning Ordinance where there is conflict.

Section 29. **Functions of the Board of Appeals.** (a) The board of appeals shall adopt from time to time such rules and regulations as it may deem necessary to interpret and to carry into effect the provisions of this ordinance, and shall recommend to the City Council such ordinances or amendments as it may deem necessary or desirable to carry into effect the provisions of this ordinance or to modify the same. Variations from or amendments to this ordinance shall in all cases be made by ordinance. The regulations imposed and the districts created under this ordinance may be varied or amended from time to time by ordinance, but no such variations or amendments shall be made without a hearing before the board of appeals, at which persons interested shall be afforded an opportunity to be heard. Notice of such hearing shall be published at least 15 days in advance thereof in a newspaper of general circulation in Chicago. Such notice shall state the time and place of the hearing and the place where copies of the proposed varying or amending ordinance will be accessible for examination by interested parties. Such hearing may be adjourned from time to time. Within 30 days in cases of amendments and five days in cases of variations after the final adjournment of such hearing the board of appeals shall make a final report and submit a proposed ordinance to the City Council. The City Council may enact the ordinance with or without change or may refer it back to the board of appeals for further consideration. Any proposed variation or amendment which fails to receive the approval of the board of appeals shall not be passed, except by the favorable vote of two-thirds of all the members of the City Council.

(b) **Amendments.** In case of written protest against any proposed amendment signed and acknowledged by the owners of 20 per cent of the frontage proposed to be altered, or by the owners of 20 per cent of the frontage immediately adjoining or across an alley therefrom, or by the owners of 20 per cent of the frontage directly opposite the frontage proposed to be altered as to such regulations or district, filed with the said board of appeals or with the City Council, such amendment shall not be passed, except by the favorable vote of two-thirds of all the members of the City Council. If any area is hereafter transferred to another district by a change in district boundaries by an amendment, as above provided, the provisions of this ordinance in regard to buildings or premises existing at the time of the passage of this ordinance shall apply to buildings or premises existing at the time of passage of such amendment in such transferred area.

(c) **Variations.** Upon application such board of appeals shall have power to review the action of the enforcing officer of the City of Chicago in order to determine whether it is in accordance with the terms of this ordinance. Where in specific cases of applications for permits there are practical difficulties or particular hardship in the way of carrying out the strict letter of the provisions of this ordinance the board of appeals shall have power upon application to recommend variations of or from the original or dinance or amendments thereto.

(d) Variations in specific cases of practical difficulties or particular hardship shall include the following, but the enumeration of such cases shall not be deemed to prevent the recommendation of other proper variations:

(1) Granting of permission to devote premises in a Residence or Apartment district to a nonconforming A use or C use, except a billboard, in a block, or in a block directly across a street from a block, in which there exists a non-conforming A use or C use respectively of a similar nature, provided that such permission shall not be so exercised as to permit either such use of premises in blocks where no such use existed at the time of the passage of this ordinance on either side of the street, and further provided that a non-conforming use herein permitted shall not exceed in area of premises or cubical contents of structures of the similar non-conforming use then existing. In granting such permission the building line regulation provided by this ordinance for the block shall be maintained, and the use permitted shall be deemed to be non-conforming in the same sense as though it were erected prior to the time of the passage of this ordinance.

(2) The extension of a non-conforming use or building upon the lot occupied by such use or building at the time of the passage of this ordinance. The erection of an additional building upon a lot occupied at the time of the passage of this ordinance by a business or industrial establishment in case such additional building is a part of such establishment, when carrying out the strict letter of the provisions would result in practical difficulties or extreme and unnecessary hardship.

(3) In undeveloped sections of the city the issuance of temporary and conditional permits for not more than two years for structures and uses in contravention of the use regulations controlling Residence districts; provided such cases are important to the development of such undeveloped sections and also provided such uses are not prejudicial to the adjoining and neighboring sections already developed.

(4) In a Residence district the location of an R2 use contrary to the provisions of Section 5, provided the R2 use will not injure neighboring property for dwelling house puposes.

(5) In a 1st, 2nd or 3rd Volume district, the moderate relaxation of the area or volume provisions of Section 16, 17 or 18 for the erection of a building for an R2 or A3 use where the premises to be devoted to such use were acquired prior to the time of the passage of this ordinance.

(6) Variation in the application of Section 10 or Section 14 in a Commercial district or part thereof in blocks adjoining the city limits of Chicago or on premises across the street from blocks in which the limitations provided by Section 10 do not apply or in neighborhoods where uses existing at the time of the passage of this ordinance are contrary to the provisions of such section or where by reason of amendment to the ordinance the said district or part thereof comes to be within 125 feet of a Residence or Apartment district, taking into consideration the conditions then existing in the blocks affected by the amendment.

(7) Variation in the application of Section 12 or Section 14 in a Manufacturing district or part thereof in locations where uses existing at the time of the passage of this ordinance are contrary to the provisions of such sections or when by reason of amendment to this ordinance any part of the then existing M2 or M3 uses in such district or part thereof come to be nearer to a Residence or Apartment or Commercial district than permitted by Section 12.

(8) Permission to maintain an M2 or M3 use anywhere in a Manufacturing district which otherwise would not be permitted by this ordinance where clearly the appropriate

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use of neighboring property is not injured thereby.

(9) Variation of the area or volume provisions of this ordinance in a block where there exists a structure which exceeds the area or volume requirements respectively of this ordinance, provided, however, that such variation shall not be construed to permit the erection of a structure in excess of the area or volume of such existing structure.

(10) In a Residence or Apartment district where lots are irregular in shape or where obviously no building line is required by reason of the peculiar conditions, or where all light is obtained from public spaces, variation of the area requirements of this ordinance and in such cases a proportionate variation in volume.

(11) Variation in the definition of the height of building where a building is erected with a frontage on a public waterway or on a natural hillside, but such variation shall be made only for the purpose of adjusting the height limits so as to conform with that of neighboring structures.

(12) Variation in the height of buildings regulations for the purpose of permitting the erection of additional stories to an existing building where it can be shown that the erection of such additional stories was contemplated, and where the original foundations were designed to carry such additional stories.

(13) Granting of permission in an Apartment district which is also in a 2nd, 3rd, 4th or 5th volume district to occupy space on the lot in addition to the area or volume permitted by Sections 17, 18, 19 or 20, of this ordinance, provided such additional space shall occupy lower floors only and further provided that such additional space shall be used only as a waiting room, lobby or lounging room or auditorium or service rooms auxiliary to an R2 or A use. In granting such permission the building line regulations provided by this ordinance for the block shall be maintained, but the volume permitted by this ordinance may be correspondingly increased.

(14) Alteration or relaxation of the provisions of Section 22, or to the extent necessary to prevent undue or peculiar hardship where in any block or portion of a block there are lots not of uniform depths, or irregular shapes or peculiar proportions, forms or topography, or fronting on more than one street, or where any frontage less in length than 100 feet has adjoining it on each side permanently less restricted frontage, or when clearly the general purpose and intent thereof will be better served thereby.

(15) Where owners of all properties in a block petition in writing for the establishment of a building line within that block, which building line is less restrictive than that which would otherwise be established by the provisions of Section 22, the alteration of the building line proposed by the petitioners.

(16) In a Residence or Apartment district the location of a special use as defined by Section 13 or the extension of an existing special use provided such location or such extension will not seriously injure the appropriate use of neighboring property, and further provided that the location of an airdrome shall be consistent with regulations, ordinances and laws then existing to control navigation of the air.

(17) Where a district boundary line divides a lot in single ownership at the time of the passage of this ordinance, the extension of the use or volume authorized on the least restricted portion of such lot over the entire lot, provided this does not extend more than 100 feet beyond the boundary line of the district in which the use is authorized.

Section 30. **Violations and Penalties.** For any and every violation of the provisions of this ordinance, the owner, general agent or contractor of a building or premises where such violation has been committed or shall exist, and the lessee or tenant of an entire building or entire premises where such violation has been committed or shall exist, and the owner, general agent, contractor, lessee or tenant of any part of a building or premises in which part such violation has been committed or shall exist, and the general agent, architect, builder, contractor or any person who commits, takes part in or assists in such violation or who maintains any building or premises in which any such violations shall exist, shall for each and every violation and for each and every day or part thereof that such violation continues, be subject to a fine of not more than $200.00. Any person violating the provisions of this ordinance by pursuing a C or M1 use which without operation of approved nuisance prevention equipment or without certain nuisance eliminating processes or methods of operation would be classified as an M2 or M3 use, or an M2 use which without such equipment, processes or methods would be classified as an M3 use, shall be deemed to have committed a separate violation of this ordinance for each day or part thereof that such C or M1 or M2 use is operated in such a manner as to violate the manifest purpose and intent of the definition of a C or M1 or of an M2 use respectively, and each complete unit of equipment shall be deemed a separate use for the purposes of this paragraph and shall be subject to the same penalty as provided herein. Legal remedies for violations shall be had and violations shall be prosecuted in the same manner as is prescribed by law or ordinance for the prosecution of violations of other ordinances, effective in the City of Chicago.

Section 31. **Remedies.** In case any building or structure is erected, constructed, reconstructed, altered, repaired, converted, or maintained, or any building, structure or land is used, in violation of this ordinance or any other ordinance or lawful regulation, the proper authorities of the City of Chicago, in addition to the remedies herein provided for, may institute any appropriate action or proceeding to prevent such unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance or use, or to impose a penalty for such violation, or to restrain, correct or abate such violation, in order to prevent the occupancy of said building, structure or land contrary to the provisions hereof, or to prevent any illegal act, conduct, business or use in or about such premises.

Section 32. **Validity of Ordinance.** If any section, paragraph subdivision, clause, sentence or provision of this ordinance shall be adjudged by any court of competent jurisdiction to be invalid, such judgment shall not affect, impair, invalidate or nullify the remainder of this ordinance but the effect thereof shall be confined to the section, paragraph, subdivision, clause, sentence or provision immediately involved in the controversy in which such judgment or decree shall be rendered.

Section 33. **Effect on Present Ordinances.** This ordinance shall not be construed as repealing or modifying any valid ordinances of the City of Chicago now in effect which restrict the location of industries, entertainments, occupations, establishments or enterprises of any kind, either by requiring frontage consents from property owners or residents affected by such location, or by prohibiting or restricting the location of same within a fixed distance from a hospital, church, public school or parochial school, or the grounds thereof, or on or near any class of streets or boulevards or any parks, playgrounds or bathing beaches. As to all other ordinances or parts of ordinances in conflict with any of the provisions of this ordinance, the same are hereby repealed.

Section 34. **When Effective.** This ordinance shall take effect and be in force from and after its passage, approval and due publication.

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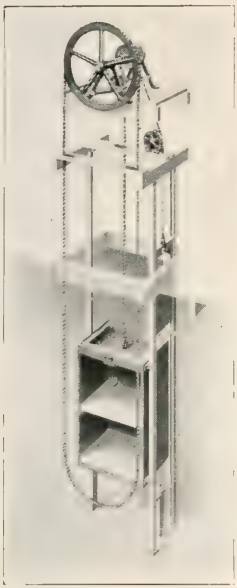

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DEPARTMENT OF ELECTRICITY, CITY OF CHICAGO

NOTICE.

Particular attention is called to the various important requirements of the Ordinances printed herein.

REGISTERED ELECTRICIAN.

Permits will be issued only to registered electricians.

Any change in the address of a registered electrician should be forwarded to the department at once.

Where the holder of a registration changes the firm name, or where additional partners are taken into a firm, or where a firm is incorporated, a notice of such change should be forwarded to the department at once, otherwise the license is liable to be voided due to its questionable ownership.

No bonds of any kind are required.

If a contractor is registered in some city in Illinois other than Chicago, he must still register in the City of Chicago before he can obtain permits. A regular application form must be filed out and submitted to the Bureau of Electrical Inspection. The fee for such registration shall be an amount equal to the difference between the registration fee in Chicago and the fee in the city in which he is registered.

Registration will not be required of any person who bears the relation of employee to the person for whom the work is done.

INSPECTION FEES.

Inspection fees shall accompany applications, otherwise permits cannot be issued.

All checks for inspection fees should be made payable to the City Collector, not to the Commissioner of Gas and Electricity. Applications for permits should be addressed to the Electrical Inspection Bureau, Room 606, City Hall. Do not mail applications to the City Collector.

In computing inspection fees, all sockets and receptacles for general illumination are considered as of 50 watt capacity, and the inspection fee must be paid on this basis. All applications for permits forwarded to the department, where the fee is figured on the basis of 25 watts, or wattage other than above will be returned to the contractor. Any deviation from this charge must be first approved by the department.

APPLICATIONS AND PERMITS.

Applications for permits shall be signed by the Supervising Electrician.

In all cases the location must be completely and correctly stated. If in an office building or other building having a number of floors, the floor or room number must be given. Where necessary the prefix East, West, North or South must be given. Failure to comply with this requirement confuses the records of the office and results in inconvenience and delays to the contractor and the public.

Application for permit must cover in a correct manner all work to be done under the particular permit. The wiring contractor generally installs, in addition to the wiring, all baseboard outlets, sidewall receptacles, and all receptacles which are attached to outlet box covers; also, in some cases, whatever drop lights are provided. All of these devices should be included in the application for permit and the fee should be paid on them. Some contractors make a practice of entering on their applications a less number of circuits or receptacles than they are actually installing. This is not only a direct evasion of the requirements of the city ordinances but it also results in the failure to pay to the City the proper fee covering the work to be done, and also involves the making out of an additional bill and the collection of the same.

Where apparatus is installed in addition to that originally applied for, full fee will be charged for such apparatus.

It is a violation of the City ordinances to install any electrical work which is not covered by an original application for permit.

Where, however, additional work is installed and the inspection fee for such work is paid within not later than thirty days after date of the bill, the department will waive the ordinance requirements, and will include such additional work as part of the original application for permit.

Where the bill referred to is not paid within the thirty day limit, provisions of the ordinance will be enforced and permit privileges will automatically cease.

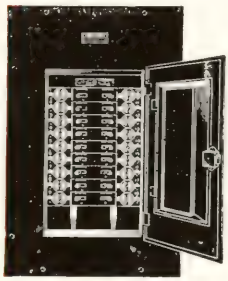
This means that unless balance bills (work done in addition to that covered by the original application for permit) for electrical inspections are paid promptly, the contractor will be considered as having violated the City ordinances in relation to the installation of electrical work without permits.

Attention is further called to the fact that no notices will be sent other than the copy of the warrant for collection itself and one delinquent notice from the City Collectors' Office and, in case of failure to pay on or before receipt of such delinquent notice, permits will automatically cease issuing and further permits will issue only upon joint approval of the Commissioner of Gas and Electricity and the City Comptroller.

Application shall be made only for the work contracted for and installed by the licensee. The obtaining of permits for work done by others will be considered cause for revocation of license. No permit must be taken out unless the contractor has a bona fide contract covering the work, nor unless the work is done by men regularly in his employ and supervised by his supervising electrician.

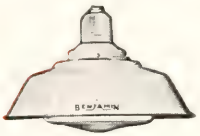
Permits shall be obtained before any work is started. Violation will be considered as sufficient cause for revocation of license.

Benjamin Show Window Reflectors and Show Case Lighting Units play an important part in bringing in larger sales for stores who realize that better lighting is almost as important as the merchandise. The same care and thoroughness are employed in making these fixtures as in all others. Complete information on request.



Panel Boards

Benjamin-Starrett Panel Boards—Built upon approved composition bases, with concealed bus bars. Stronger, smaller, lighter—quickly procured, easily installed. Benjamin-Starrett Panel Boards are made either in the Safety, Dead Front or Open Front types. Two fuses, or one fuse, cartridge or plug, various types of branch switches as well as main connections, including a safety type fused main switch.



Glassteel Diffuser

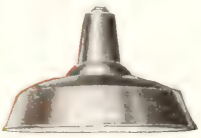
The Glassteel Diffuser is a handsome, efficient unit, particularly adaptable for light manufacturing and semi-industrial installations. It combines a white porcelain enameled steel R L M Dome Reflector with a totally enclosing glass bowl. Apertures in the top of the reflector permit a portion of the direct light of the lamp bulb to reach the ceiling.

Heavy Duty Type R R Fixture

Type R R Threaded Fixtures comprise a line for heavy duty interior and outdoor use. Threaded hoods of the cast and porcelain enameled steel types for pendant suspension and cast and porcelain enameled steel threaded hoods of the outlet box type provide a means for attaching R L M Dome, Bowl or Symmetrical Angle Reflectors. Permits easy removal of reflector for cleaning or for change in size or style.

Elliptical Angle Reflector

Elliptical Angle Reflectors. Used where a vertical surface must be lighted or where overhead mounting is not possible. Made of Porcelain Enameled Steel. Furnished with extra heavy X-type separable weatherproof fitting. Keyless or straight-down inside pull-chain socket.



R L M Dome Reflector

R L M Dome Reflector Sockets are of Porcelain Enameled Steel, seamless, one piece. Furnished with extra heavy X-type separable weatherproof fitting. Keyless socket. Furnished with Benjamin Lamp Grip and may be equipped with Benjamin Locking Socket.

Benjamin Electric Mfg. Co.

120-128 S. Sangamon Street

247 W. 17th Street New York — Chicago — 448 Bryant Street San Francisco

Manufactured in Canada by The Benjamin Electric Mfg. Co. of Canada, Ltd., Toronto, Ontario.

DEFECT NOTICES.

Many contractors fail to return the return slip on letters of defects sent to them. The return slip referred to is a notice to the inspector that the defects have been taken care of and failure to receive this notice results in delays and in many cases unnecessary inspections.

The return of these notices is essential to the inspector's work, and the department must insist on a strict and prompt compliance in this matter, otherwise it will be necessary to withdraw, from those contractors who violate this rule, the privileges now granted to them, such as the issuance of current permits previous to the completion of the work

Every notice of defects carries with it a limited time in which the repairs or changes noted must be made. The change must be made within the time specified, unless, for special reasons, this time is not sufficient, in which event the department must be notified by letter and an extension of time requested.

SIGN APPLICATIONS.

The department has experienced considerable trouble through sign contractors taking out permits for the erection of signs where no provision has been made for the connection between the sign and the building wiring. In many of these cases, on inspection, dangerous and defective wiring is found by the inspectors and often the information is given to the inspector that this wiring is installed by the sign hanger.

The department is put to considerable trouble extending over long periods in obtaining a compliance with the rules of the department on the proper installation of the sign connections.

In order to obviate this trouble the department will issue no permit for the erection of electric signs until a permit has been issued by this department for mains for the same or for the connection of the sign to outlets already provided.

GENERAL.

The wiring contractor must connect up all switches and receptacles installed by him. He must also pole up all wires at fixture outlets and must solder and tape all such wires except those to which a fixture is to be attached.

The use of electric current is prohibited previous to the issuance of a current permit or certificate.

Temporary work must be inspected and approved before current is used on the same.

Alterations to existing wiring must not be made without obtaining a permit.

Violation of the ordinance constitutes a misdemeanor and is punishable by a fine of from $5.00 to $50.00, also by the cutting off and stopping the use of current.

JOHN T. MILLER,
Commissioner of Gas and Electricity.

SPECIAL SUGGESTIONS TO ARCHITECTS.

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 40 watt or equivalent.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

SPECIAL NOTICE.

Service switches, cutouts and meters must, when practicable, be placed in basements or other public portions of the building. Exception will be made for cutouts in the case of apartment buildings having 4 circuits or more per apartment or where the building is four stories or more in height. Where cutouts are located in apartments or on the various floors of residences, etc., they must never be located in clothes closets or any other location where combustile material is stored.

Service switches, cutouts and meters should not be installed above or in close proximity to laundry tubs, sinks, gas meters or plumbing fixtures.

Meter outlet fittings must be of approved construction.

A separate fitting is required for each meter.

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Economy "Drop Out" Renewal Link and Winged Washer

Knife Blade Type Disassembled

ECONOMY FUSES are made in three general types (ferrule, plug, and knife blade), with a full line of capacity ranges for all commercial voltages. This was the first line of fuses employing an inexpensive bare link for restoring a blown fuse to its original efficiency to be approved in ALL CAPACITIES by the Underwriters' Laboratories, Inc., established and maintained by the National Board of Fire Underwriters.

The fusible elements are of the "Drop Out" renewal link type, accurately rated and of definite design. In operation on short circuits the entire fuse metal does not volatilize; only the two narrow bridges of metal that hold the drop out portion fuse. There is no powdered filler to deteriorate or to solidify. The winged washer in knife blade type and the end plug in ferrule type make replacement of link quick and easy.

Since every part of an Economy Fuse excepting the link is good for years of service, their use will give an annual saving of 80 per cent in fuse maintenance costs compared to one-time fuses.

Ferrule Type and "Drop Out" Link

Write "Economy Fuses" Into Your Specifications for Electrical Fusing.

ECONOMY ELEXITS AND PLUGS

ECONOMY FUSE & MFG. CO. is producing and marketing, under license agreement, Economy Elexits and Elexit Plugs. Our service and co-operation is offered to the fixture manufacturer and dealer, to the architect and to electrical dealers and contractors, for developing universal standardization and use of this modern method of installation of electric lighting fixtures. Write for catalog LX-47.

CLEAR SITE Plug Fuses

Clearsite Fuses represent the highest form of convenience in the art of fuse manufacture. They are the only non-renewable plug fuses using the famous Economy "Drop Out" Link, which greatly reduces the internal operating pressure.

The clear window makes it easy to see the link—with the amperage stamped thereon—and when the fuse has blown on overload a gap in the operative section is plainly discernible. When blown on short circuit the blackened window renders vision of the link impossible. There is no doubt of the condition of Clearsite Fuses at all times. Packed in standard carton quantities, and in retail packages of four fuses for 25 cents.

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SECTIONS OF THE CHICAGO MUNICIPAL CODE OF 1922 OF THE CITY OF CHICAGO GOVERNING ELECTRICAL INSPECTIONS

AN ORDINANCE

Providing for the Registration of Electrical Contractors and Fixing a Fee Therefor.

Passed July 22, 1925; Amended August 4, 1925.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CTY OF CHICAGO:

Section 1. That Chapter XXXVI of The Chicago Municipal Code of 1922 be and the same is hereby amended by striking out Article II, containing Sections 1631 to 1641 inclusive, and by substituting the following in lieu thereof:

ARTICLE II

Registration of Electrical Contractors.

1631. **Electrical Contractor Defined.)** The term "electrical contractor," as used in this article shall be understood to mean any person, firm or corporation engaged in the business of installing or altering by contract electrical equipment for the utilization of electricity supplied for light, heat or power, except apparatus, conductors or other equipment installed by public utilities and common carriers which are under the jurisdiction of the Illinois Commerce Commission.

1632. **Registration.)** It shall be unlawful for any person, firm or corporation to install wires or other apparatus for electrical currents to be used for light, heat or power by contract or to engage in the business of electrical contractor as herein defined, without being registered as an electrical contractor in the manner hereinafter set forth; provided, that electricians employed by an electrical contractor to do or supervise such work shall not be included within the meaning of the term "electrical contractor;" and provided, further, that the words "by contract" shall not apply to or include electrical equipment installed or altered by a person who bears the relation of employee to the person for whom the work is done.

1633. **Application for Registration.)** Any person, firm or corporation desiring to engage in the business of electrical contractor shall apply for registration to the commissioner of gas and electricity, and shall file with the application an affidavit stating that the applicant (if an individual) or at least one member of the firm (if the applicant is a firm) or at least one representative of the corporation (if the applicant is a corporation) has had at least two years' practical experience in installing and altering electrical equipment for light, heat or power, and has had a thorough knowledge of the ordinances of the City of Chicago on the subject of electrical inspection. Upon the filing of such application in proper form and the payment of the registration fee fixed herein, the commissioner of gas and electricity shall register the applicant as an electrical contractor, and shall issue to the applicant a certificate of registration which will authorize the applicant to engage in such business for the year in which it is issued.

1634. **Fee for Registration—Term.)** The fee for registration as an electrical contractor shall be fifty dollars ($50.00) per annum which sum shall be paid by the applicant to the City Collector in advance upon filing the application; provided, that when such application is made by an applicant not previously registered on or after July first of any year, the fee for registration shall be $25.00 for the remainder of such calendar year. The certificate of registration issued thereunder shall expire on the 31st day of December of the year in which it is issued.

1635. **Penalty.)** Any person, firm or corporation that shall engage in the business of electrical contractor without obtaining a certificate of registration as herein provided for, or that shall violate any of the provisions of this article, shall be fined not less than twenty dollars nor more than one hundred dollars for each offense, and a separate and distinct offense shall be regarded as committed every day on which such person, firm or corporation shall continue to operate contrary to the provisions of this article.

Section 2. This ordinance, including the provisions and penalty therein set forth, shall take effect and be in force from and after its passage and due publication.

AN ORDINANCE

Providing for the Inspection of Electrical Equipment for Light, Heat and Power.

Passed July 22, 1925.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHICAGO:

Section 1. That Chapter XXXVI of The Chicago Municipal Code of 1922 be and the same is hereby amended by inserting immediately before Article III of said chapter, a new article to be known as Article II-A, containing headings and sections numbered 1636 to 1641 inclusive, to read as follows:

ARTICLE II-A.

Installation and Alteration of Electrical Equipment.

1636. **Bureau Established.)** There is hereby established a bureau within the department of gas and electricity which shall be known as the electrical inspection bureau. Such bureau shall be the electrical inspection department of the City of Chicago authorized by the Act of the General Assembly of Illinois approved June 30, 1925, entitled "An Act in relation to the regulation or the installation and alteration of electrical equipment." Such bureau shall consist of the chief electrical inspector of the city and such other employees as may from time to time be provided for in the annual appropriation ordinance. Such electrical inspection department shall be charged with the duty of enforcing the provisions of the electrical code or other rules and regulations fixing standards and specifications for the installation and alteration of electrical equipment as defined in said Act for purposes of light, heat and power to be prescribed by the electrical commission hereinafter provided for, and shall function under the immediate supervision and control of the commissioner of gas and electricity.

1637. **Electrical Commission Created.)** There is hereby established a commission to be known as the Electrical Commission of the City of Chicago, which shall consist of five members. The commissioner of gas and electricity shall be a member, and **ex-officio** chairman, of such commission. Of the other four members, one shall be an electrical contractor, one a journeyman electrician, one a representative of the board of fire underwriters, and one a representative of an electricity supply company, who shall be appointed by the Mayor by and with the advice and consent of the City Council. The commissioner of gas and electricity shall serve on such commission without additional compensation therefor. The other members shall receive such compensation as may be fixed by the City Council in the annual appropriation ordinance.

1500 Clear Top Attalites Installed in the New Union Station, Chicago, Ill.

Graham, Anderson, Probst & White, Architects and Engineers

ON one of Chicago's busiest boulevards majestically stands the new Union Station Building. This distinctive structure commands the admiration of all who pass and reflects the ideals of America's most noted architects and engineers. This building is indeed a source of pride to Chicago.

It is of equal pride to the Central Electric Company that clear top Attalite Luminaires were chosen for the illumination of the offices of this building.

This installation marks another epoch in Attalite history.

The Clear-Top Attalite Luminaire is recommended for installation in offices and public buildings where semi-indirect light is preferable to direct or enclosed direct lighting. The uniformity of light distribution is better, owing to the fact that a large percentage of the light on the working plane is delivered from the ceiling as a secondary source.

This unit has an advantage over the open bowl semi-indirect type in that, like all Attalites, it is totally enclosed and therefore does not accumulate dust as rapidly. The upper surface can be very readily cleaned without removing the bowl from the fixture.

Installations in the offices of the Union Station and other buildings are giving eminent satisfaction, therefore our recommendation accompanies Clear-Top Attalite.

Technical data upon request

Central Electric Company

CALCO *The House of Service*

316-326 South Wells Street

CHICAGO

1638. **Duties of Commission.)** As soon as practicable after the Electrical Commission of the City of Chicago shall have been appointed the said commission shall meet and organize and it shall then forthwith formulate and recommend safe and practical standards and specifications for the installation and alteration of electrical equipment designed to meet the necessities and conditions that prevail in the City, and shall prescribe the fees to be paid for the inspection by the electrical inspection department, of all electrical equipment installed or altered within the City except such as is exempt from the provisions of this ordinance by the terms of the Act mentioned in Section 1636. The standards and specifications so recommended and the fees so prescribed shall become effective upon the passage of an ordinance approving same by the City Council.

1639. **Permits for Installation.)** Upon the approval of the standards and specifications and the fees prescribed for inspection, as provided for in the last preceding section, the same shall at once become operative, and thereafter no electrical equipment shall be installed or altered except upon a permit first issued by the electrical inspection department. The electrical inspection department shall issue permits for such installation and alteration of electrical equipment, to electrical contractors, in all cases where applications shall have been made in accordance with the regulations established by the said electrical commission and the fee prescribed therefor shall have been paid to the city collector. The said electrical inspection department shall inspect all such electrical equipment installed or altered and shall require that it conforms to the standards and specifications applicable thereto which have been recommended and approved as herein provided for.

1640. **Additional Inspections.)** The provisions for inspection of work authorized by the permits issued in accordance herewith shall not be construed as prohibiting the inspection of any electrical wiring or apparatus now or hereafter installed whenever the commissioner of gas and electricity shall determine that the public safety requires it. No inspection fee shall be charged for such extra or additional inspection, but in case it becomes necessary to replace such wiring or apparatus on account of defects disclosed by such inspection a permit therefor shall be obtained in like manner as in the first instance.

1641. **Penalties.)** Any person, firm or corporation that shall install or alter any electrical equipment after the approval of the standards and specifications and the fees prescribed therefor, except such as is exempt from the provisions of this ordinance by the terms of the Act mentioned in Section 1636, without first having secured a permit as provided for herein, or any person that shall wilfully fail or refuse to comply with the rules, standards or specifications established by the Electrical Commission of the City of Chicago which have been approved by the City Council, shall, upon conviction thereof, be fined not less than five dollars nor more than fifty dollars for each offense.

Section 2. This ordinance, and the penalties therein prescribed shall take effect and be in force from and after its passage and due publication.

AN ORDINANCE
Passed August 4, 1925.

Approving the recommendations of The Electrical Commission of the City of Chicago and adopting them as ordinance of the City of Chicago.

WHEREAS, The Electrical Commission of the City of Chicago has adopted standards and specifications for the installation and alteration of electrical equipment designed to meet the necessities and conditions that prevail in the City of Chicago, and has recommended the same as safe and practical, and has asked the approval of the City Council thereto; and

WHEREAS, The said Commission has also prescribed fees for electrical inspection for the installation and alteration of electrical equipment for purposes of light, heat and power, and has asked the approval of the City Council thereto, therefore,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHICAGO:

Section 1. That the recommendation of The Electrical Commission of the City of Chicago of the standards, specifications, rules and regulations for purposes of installation and alteration of electrical equipment contained in the 1923 edition of the "Rules and Regulations of the Department of Gas and Electricity of the City of Chicago," issued by the Commissioner of Gas and Electricity of the City of Chicago as safe and practical standards and specifications for such purpose in said City, be and the same is hereby approved, and the said standards, specifications, rules and regulations are hereby adopted for the regulation and control of such installation and alteration of electrical equipment in the City of Chicago.

Section 2. That the fees prescribed by The Electrical Commission of the City of Chicago for electrical inspection for installation and alteration of electrical equipment for purposes of light, heat and power, be, and the same are hereby approved and adopted as the fees for such inspection in the City of Chicago, said fees being as follows: (Fees as published in the 1923 Electrical Code).

FEES.

Wiring Only for Lighting Circuits. (Not including Fixtures, Sockets or Receptacles.) For the inspection of each complete branch lighting circuit of 1,000 watts or less: one dollar and fifty cents for one circuit, one dollar and twenty cents for each of the next four circuits, one dollar for each of the next five circuits, eighty-five cents for each of the next five circuits, seventy-five cents for each of the next five circuits, sixty-five cents for each of the next five circuits and sixty cents for each succeeding circuit.

For the inspection of each complete branch lighting circuit of larger capacity than 1,000 watts the charge shall be in proportion to the wattage of such circuit.

For the inspection of additional outlets on existing circuits: ten cents for each outlet on which a socket, receptacle or fixture will be attached.

Electrical Fixtures, Sockets and Receptacles. (Not including the circuit feeding same.) For the inspection of fixtures, sockets or receptacles for lamps of nominal fifty watts capacity; one to fifteen lamps, fifty cents; sixteen to twenty lamps, seventy-five cents; twenty-one to twenty-five lamps, one dollar; twenty-six to thirty lamps, one dollar and twenty-five cents; thirty-one to forty lamps, one dollar and fifty cents; forty-one to fifty lamps, one dollar and seventy-five cents; fifty-one to sixty lamps, two dollars; sixty-one to seventy lamps, two dollars and twenty-five cents; seventy-one to eighty lamps, two dollars and fifty cents; eighty-one to ninety lamps, two dollars and seventy-five cents; ninety-one to one hundred lamps, three dollars; one hundred and one to one hundred and ten lamps, three dollars and twenty cents; one hundred and eleven to one hundred and twenty lamps, three dollars and forty cents; one hundred and twenty-one to one hundred thirty lamps, three dollars and

THE NEW AND IMPROVED **UNION** RENEWABLE FUSE

Reduces Maintenance to a Minimum

Withstands an Exceptionally Large Number of Blowouts

SPECIFY Union Fuses for protecting electrical circuits and equipment. Insure dependable service at minimum cost.

Union Fuses are the result of 30 years' experience in design and manufacture, and are made in all types for power and lighting circuits. The complete line includes plug fuses, renewable and non-renewable fuses, indicating and non-indicating fuses, all approved by the National Board of Fire Underwriters.

The enclosed renewable knife-blade type illustrated above represents the most important development in fuse design in recent years, and has many advantageous features that are important to every user of fuses.

Catalog and complete information on request.

CHICAGO FUSE MFG. CO.

MANUFACTURERS OF

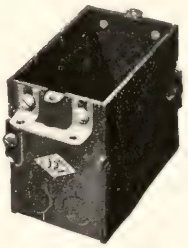
ELECTRICAL PROTECTING MATERIALS AND CONDUIT FITTINGS

1531 West 15th Street
CHICAGO, ILL.

UNION Outlet Boxes and Covers

Made in various types and sizes for all classes of wiring

GEM
Sectional Switch Boxes
The original and genuine



Made for loom, flexible and rigid conduit—take all standard flush switches and receptacles

sixty cents; one hundred and thirty-one to one hundred and forty lamps, three dollars and eighty cents; one hundred and forty-one to one hundred and fifty lamps, four dollars; one hundred and fifty-one to one hundred and sixty lamps, four dollars and twenty cents; one hundred and sixty-one to one hundred and seventy lamps, four dollars and forty cents; one hundred and seventy-one to one hundred and eighty lamps, four dollars and sixty cents; one hundred and eighty-one to one hundred and ninety lamps, four dollars and eighty cents; one hundred and ninety-one to two hundred lamps, five dollars; above two hundred lamps, twenty-five cents for each group of twenty-five lamps or less. For lamps of larger or smaller capacity the charge shall be in proportion to the wattage of the lamp.

Wiring and Fixtures. For the inspection of both circuit wiring and fixtures, sockets or receptacles: The aggregate sum of the fees as shown above for wiring and for electrical fixtures.

Motors and Other Forms of Power. For the inspection of each electrical horsepower of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, the sum of one dollar for each horsepower from one to five horsepower, inclusive; for each of the next succeeding five horsepower, seventy-five cents; for each of the next succeeding five horsepower, sixty-five cents; for each of the next succeeding ten horsepower, fifty-five cents; for each of the next succeeding twenty-five horsepower, fifty cents; for each of the next succeeding two hundred horsepower, twenty-five cents; for each of the next succeeding two hundred and fifty horsepower, ten cents; and for each additional horsepower, five cents.

Temporary Work, Outside Work, Etc. Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same, temporary installations for show window exhibitions, conventions and the like, underground or overhead wires and apparatus, and all other inspections not specifically provided for herein, shall be charged for according to the time required for such inspection at the rate of one dollar per hour.

Re-Inspections. Each re-inspection of any overhead, underground or interior wires or apparatus shall be charged for according to the time required for such re-inspection at the rate of one dollar per hour.

Extra Inspections. Where extra inspections are made on account of any of the following reasons a charge of one dollar shall be made for each such inspection; inaccurate or incorrect information, failure to make necessary repairs, faulty constuction.

Minimum Fee. No inspection shall be made for a less amount than one dollar.

ARTICLE III. ILLUMINATED SIGNS.

"1643. **General Requirements—Definition.)** It shall be unlawful for any person or corporation to erect or maintain over any sidewalk, street, avenue, alley or public way in the city, any illuminated signs, except in accordance with the ordinances of the City of Chicago.

For the purpose of this Article illuminated signs shall be declared to be signs constructed as follows: Signs, all or any part of the letters of which are made in an outline of incandescent lamps; signs with painted, flush or raised letters, lighted by an electric lamp or lamps attached thereto; signs having a border of incandescent lamps attached thereto and reflecting light thereon; and transparent glass signs whether lighted by electricity or other illuminant.

"1644. **Inspection Fees.)** The owner or person having charge or control of any illuminated sign authorized by this Article, which projects in whole or in part over any sidewalk, street, avenue, alley or public way in the city shall pay for the use of the city as compensation for the maintenance of same in such place, and to cover the cost of inspection, an annual fee to be computed according to the following classification and schedule:

Projecting Signs.

The fee for all signs projecting at right angles or obliquely from the building against which same are placed, whether such signs are vertical or horizontal, and not being flat signs as hereinafter described, shall be computed at the rate of fifteen cents per annum per square foot of sign surface on each illuminated side of such signs.

Flat Signs.

The fee for all signs placed against a building running parallel thereto and not projecting obliquely or at right angles therefrom containing twenty-five incandescent lamps or less shall be two dollars and fifty cents, to which shall be added nine cents for each of the next additional twenty-five lamps, eight cents for each of the next twenty-five lamps, seven cents, for each of the next twenty-five lamps, six cents, for each of the next one hundred lamps, five cents, for each of the following one hundred lamps, and four cents for each additional lamp above three hundred. Where illumination is by other means than incandescent lamps, the fee shall be in the same proportion, as nearly as may be, based on the illuminated area of the sign.

Temporary Signs.

The fee for illuminated signs installed for temporary use for special occasions not to exceed thirty days shall be computed at one-fourth of the annual rate fixed for the particular type or style of sign, whether projecting or flat.

"1645. **Application—Permit.)** Any person or corporation desiring to erect and maintain an illuminated sign over any sidewalk, street, alley or public way in the city shall make application to the Commissioner of Gas and Electricity for that purpose on a printed form to be furnished therefor by the Department of Gas and Electricity, setting forth in such printed form such information as is required by said department. Such application when made shall be submitted by the Commissioner of Gas and Electricity to the Commissioner of Public Works for his approval as to the location of such sign, and when the approval of the Commissioner of Public Works shall be placed upon such application as to the location thereof the Commissioner of Gas and Electricity shall issue to such applicant, upon the payment by such applicant to the City Collector of the compensation as herein fixed, a preliminary permit in writing, authorizing such applicant to erect a sign at the location designated in such application and of the style or design described therein. Upon the completion of the work of erecting such sign under such temporary permit the applicant shall forthwith notify the Commissioner of Public Works who shall approve the condition of the same with respect to its safety and location exclusive of its lighting features, and then notify the commissioner of gas and electricity, who shall thereupon cause a further inspection of such sign to be made; and if the commissioner of gas and electricity shall find that such sign has been constructed and erected in accordance with the ordinances of the City of Chicago, he shall thereupon issue to such applicant a permit in writing authorizing such applicant to operate and maintain the sign so erected for the

Just What "Frink" Stands For In The Lighting World

IN case you too are under the impression that Frink is the name of a reflector this will set you straight.

Frink is the sign of a Service. A Service that develops and sells ideas for unusual methods of electric illuminating. A Service that sells results.

Incidentally we manufacture and deliver the equipment necessary to produce the results we sell.

Starting before the days of electric lighting, for over 66 years this Service has been developed through hundreds of thousands of contracts.

Frink Service reaches everywhere that electric lighting can be used. There is seldom a job too small for it to be economically employed. Certainly none is ever too large.

At any time one of us would be glad to explain our Service more in detail, or confer with you over any lighting problem you may have.

I. P. FRINK Inc.

24th St. and 10th Ave.

NEW YORK

REPRESENTATIVES IN PRINCIPAL CITIES

period of one year from the date of the issuance thereof; such permit to be issued without further cost or expense to the applicant other than the fees hereinbefore provided.

The use of electrical current or of any other illuminant, by such applicant in connection with such sign previous to the issuance of the permit last described, is prohibited and no electrical current, or other illuminant, shall be turned on, or into, such sign, previous to the issuance of such permit, except by order of the Commissioner of Gas and Electricity, for the purpose of testing the same to see whether it is constructed in accordance with, and pursuant to, the provisions of this chapter.

No alteration shall be made on any sign erected or maintained under the authority of this Article unless all the provisions hereof are fully complied with and unless a permit expressly issued for the purpose of allowing such alterations be first secured from the Commissioner of Gas and Electricity.

"1646. **Location—time of Illumination.)** Every sign erected under and pursuant to the provisions of this Article shall be placed at least nine feet above the surface of that part of the public way which any such sign overhangs, and the portion of any such sign nearest to the building against which it is placed shall not be a greater distance than two feet from such building.

No illuminated sign shall be permitted to project beyond the curb line.

It shall be the duty of the commissioner of public works to cause the removal of any sign erected under a temporary permit unless the sign is completed in a reasonable time and a final permit issued therefor.

All sides of every such sign designed to be illuminated shall be illuminated each and every night for a no less period of time than from dusk until the hour of 9:30 p. m.

The authority granted for the erection of any such sign may be revoked at any time by order of the Mayor or of the City Council, and any inspection to permit fees paid to the city for such sign shall not be refunded in case of any such revocation.

"1647 **Compliance with Rules.)** Every sign erected and maintained under and pursuant to the provisions of this Article shall comply with the provisions of this Article, and be installed in a safe and secure manner.

"1648 **Penalty.)** Any person or corporation who shall erect or maintain an illuminated sign, or use any electric current or other illuminant in any sign in violation of any of the provisions of this Article shall be fined not less than fifty dollars, nor more than one hundred dollars for each offense, and shall be fined a further sum of ten dollars for each and every day on which he or it shall permit or cause any such sign to be erected or maintained or any electric current or other illuminant to be used therein in violation of any of the provisions of this Article; and in addition to such penalties the Commissioner of Gas and Electricity shall for any violation of any of the provisions of this Article compel the cutting off and stopping of electric current or other illuminant supplied to any such sign, and if deemed necessary or advisable by him he shall order such sign removed.

"919. **Illuminated Roof Signs.)** (Permit to be obtained from Building Department. Fee for electrical inspection same as for Flat Signs, Section 1644. To be reinspected annually.)

NOTE 207. INCLOSING LIVE PARTS.

All live parts of apparatus shall be so guarded or isolated as to be accessible only to qualified persons.

All apparatus with live contacts, the operation of which can produce sparks or arcs, shall be inclosed or so located that such sparks or arcs cannot come in contact with combustible material.

These rules shall not apply to trolley wires or other exposed live parts which from the nature of their use cannot be inclosed.

It is the intent of this rule to require such protection of live parts of electrical apparatus as will eliminate, as far as possible: (1) Accidents from contact with live parts. (2) Fires which may result from sparks or flames produced in the operation of electrical apparatus.

The protection of live parts against accidental contact will be required on all apparatus where a person not familiar with the electrical apparatus may accidentally come in contact with such live parts. Such protection shall only be required where the potential of the exposed live parts exceeds 50 volts.

The protection of arcing contacts will be required on all apparatus so situated that such arcing contacts might produce fires.

Protection of live parts may be obtained by so locating apparatus that the live parts are not easily accessible. This may be accomplished by elevating the apparatus 8 feet or more above the floor; by locating the apparatus in an engine room or other location where accessible only to authorized electricians.

Protection of arcing contacts may be obtained by locating such arcing contacts in fireproof locations where there is no liability of combustible material being placed near them.

Where there are live parts which cannot be protected by location as described above, then such live parts must be provided with such inclosures as will afford the protection required above.

It is intended that the inclosure referred to will be provided in the design of the apparatus and will be supplied by the manufacturer.

The effect of the rule on various classes of apparatus, where such apparatus cannot be protected by its particular location as described above, is herewith given:

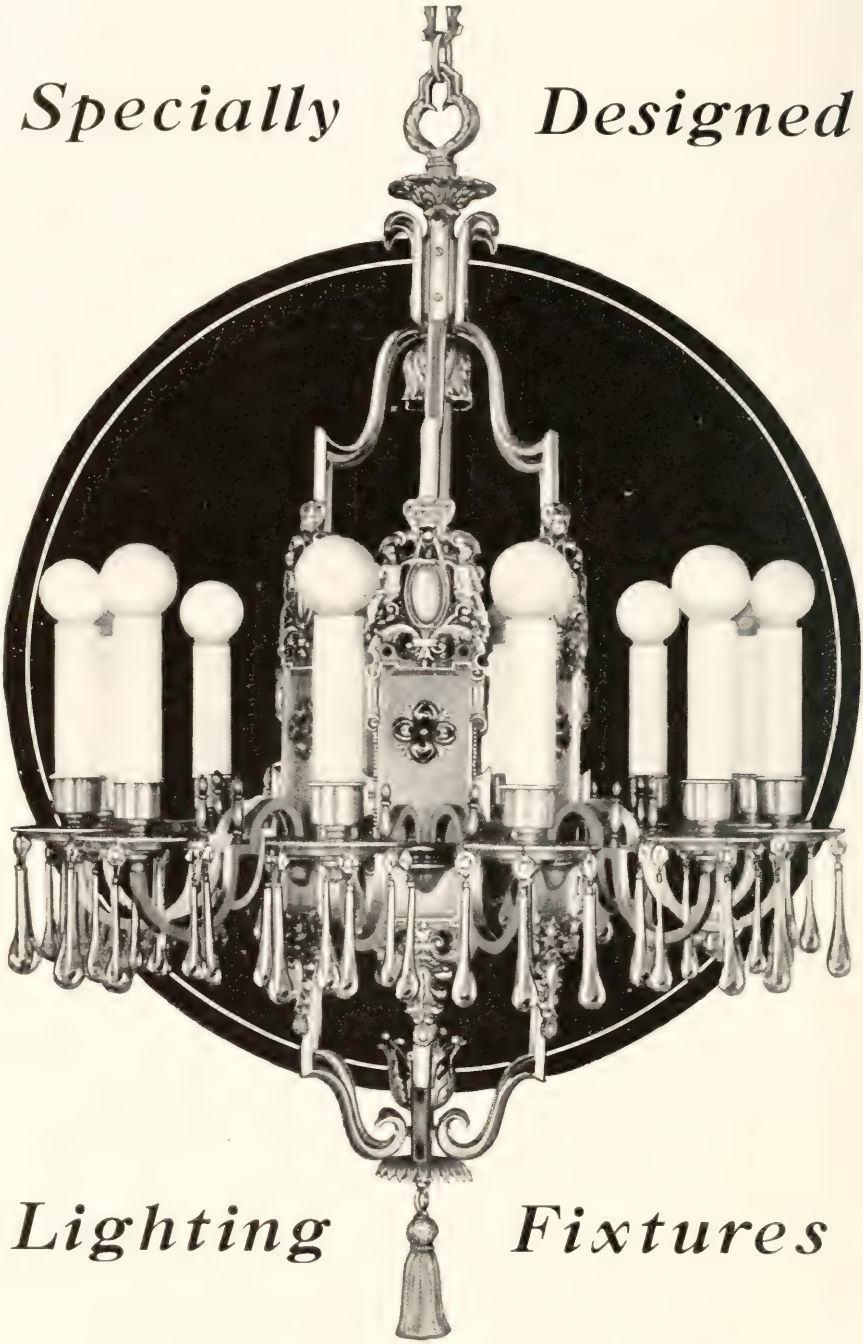
TERMINALS OF APPARATUS.

Exposed binding posts shall not be used unless all live parts of both binding post and connections to the same are so insulated that contact cannot be accidentally made with the live parts.

For portable apparatus using flexible cord connections the conductors may enter the apparatus and be connected directly to the interior conductors if provided with a means of strain relief; or a separable plug may be used with the connecting cord terminating in the separable part. Separable plugs shall be so connected that there will be no exposed live parts when the plug is disconnected.

For non-portable apparatus the design shall be such as to allow the direct entrance

Specially Designed



Lighting Fixtures

C. G. EVERSON & CO.

70 West Lake Street, CHICAGO

of conduit to the interior of the apparatus and the connection of the conductors to the interior binding posts or conductors, or a junction box may be attached to the apparatus frame and connections made within it.

For motors, or other apparatus, so installed that a small adjustment of position can be made for belt tension, or similar purpose, a short length of flexible steel conduit or of steel armored cable shall be used to allow for the adjustment, and care shall be taken that its fastenings shall be secure and permanent.

As flexible conduit is not made in sizes larger than 2½ inches, belted motors of sizes greater than 30 H. P. 110 volt, D. C., 65 H. P. 220 volt, D. C., 75 H. P. 220 volt, 3-phase, and 150 H. P. 440 volts, 3-phase, are excepted from the requirements of this rule. Where conduit is not carried direct into motor terminal fittings the conduit should be terminated as close to the motor terminals as conditions will permit and should be equipped with a standard outlet fitting. The wires should be separated and run direct to motor terminals or lead-in wires and, where there is a liability of these wires coming in contact with each other or with grounded material, they should be protected with flexible tubing.

MOTORS.

Commutators shall be protected against accidental contact. This may be accomplished by guards so designed that accidental contact cannot be made with live parts, or by a special design of the motor itself. Where protection of arcing contacts is required the commutator shall be so inclosed that sparks from the commutator cannot get outside the inclosure.

Covers: If the design of the motor does not already provide the necessary protection, then the motor shall be fitted with protecting covers in accordance with the following specifications:

Commutator or Slip Ring End of Motors: The commutator or slip rings shall be protected by hinged covers of such dimensions that when opened, all parts requiring inspection or adjustment are readily accessible. The hinges, unless they are an integral part of the cover or motor, shall be fastened to both the cover and to the motor by rivets or screws, and if screws are used the ends shall be upset. If such parts are readily inspected or adjusted through the cover openings located in the upper half of the end bracket, the balance of the end bracket may be provided with covers permanently fastened by rivets or screws, and if screws are used the ends shall be upset.

Protection Against Contact: When necessary to provide protection against contact, the size of the openings in all cases shall not exceed ½ square inch in area and must be of such shape as not to permit the passage of a rod larger than ½ inch in diameter, except where the distance of live parts from the openings in the cover is more than 4 inches, the openings may be ¾ square inch in area, but shall be of such shape as not to permit the passage of a rod larger than ¾ inch in diameter.

Protection Against Fire: When necessary to provide protection against fire, the motor when installed shall have the bottom half of the end bracket without openings, or with openings covered with wire screen having a mesh of not less than 10 openings to the inch or metal covers having round holes not more than .08 inch in diameter. (This protection is not to be considered as affording a means to prevent explosions.)

Back or Pulley End of Motor: No covers or screens are required on the pulley end of the motor unless commutators, slip rings or other live unprotected parts are installed on that end, in which event the same protection shall be provided as is prescribed for the commutator or slip ring end.

This ruling applies to motors of all sizes, including the smaller types of motors used on electric fans, vacuum cleaners and the various motor-operated household and other appliances.

CONTROLLERS.

Manually operated starting boxes, speed controllers and the like shall have inclosures of such design that all live parts are completely inclosed and shall be so arranged that the device can be operated from the outside of the inclosure. This protection shall be obtained by the design of the device. The placing of a manually operated starting box inside a metal cabinet, where it is necessary to open the door of the cabinet to operate the device, is not acceptable.

Automatic starting boxes and similar electrically controlled devices shall be placed in standard cabinets provided with hinged doors.

AUTOMATIC CONTROL BOARDS.

Including automatic elevator controllers and similar devices, unless placed in fireproof locations and guarded (by screens or location) so that unauthorized persons cannot make contact with same, shall be placed in metal inclosures.

For elevators located in fireproof rooms the room shall be used only for the inclosure of the elevator machinery and the electrical control apparatus. The entire room, including floor, shall be of fireproof construction.

THE HERWIG CO.

MANUFACTURES

CAST-METAL
OUT-DOOR LIGHTING FIXTURES

1753-59 Sedgwick Street, Chicago, Ill.

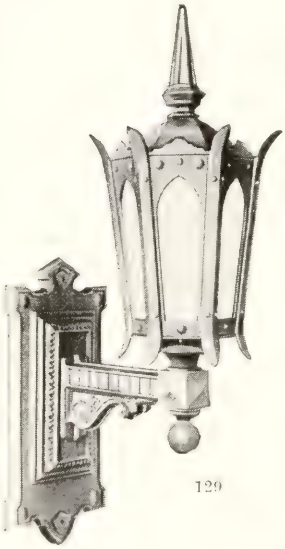
Phone Lincoln 5935

A Fixture for Every Purpose

On this page we show a few fixtures taken from our Catalog No. 25. Send for it.

Any fixture shown in catalog can be furnished in bronze

PRICES ON APPLICATION



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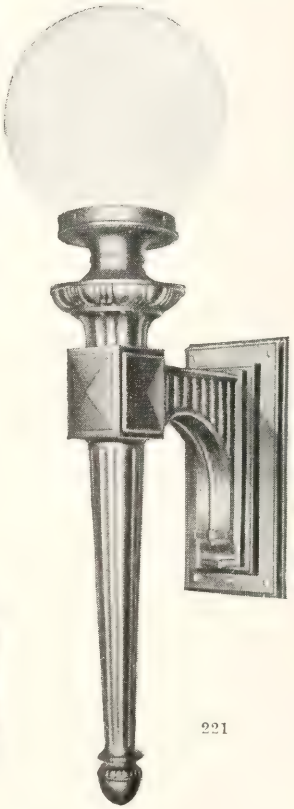

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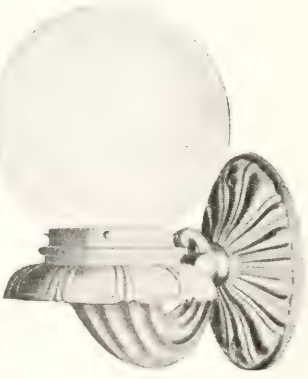

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For the fireproofing of the floor concrete, tile or sheet metal shall be used. Concrete shall be at least 3 inches thick and when placed over wood floors all openings through such floors shall have the exposed ends of boards covered by sheet metal. Sheet metal used as a floor covering shall be not less than No. 14 U. S. S. gage. Ceilings, if of wood, may be covered by metal lath and plaster or by transite board not less than ¼ inch thick. All doors to the room shall be kept locked.

AUTO STARTERS, COMPENSATORS, ETC.

Where there are no exposed live parts, no special protection is required. Where no voltage or overload coils having exposed contacts are used, such contacts shall be inclosed.

RESISTANCE GRIDS.

All types of resistance grids shall be protected against accidental contact either by location or by suitable ventilated inclosures. It is intended that the protective inclosure for grids shall be furnished by the manufacturers as a part of the device.

CIRCUIT-BREAKERS.

Circuit-breakers shall be inclosed in metal cabinets and, if used in place of a switch, shall be operable from the outside of the inclosure.

SPECIAL PANELBOARDS.

Such as dental boards and similar apparatus shall have live parts protected.

ELECTRIC HEATERS.

Electric heaters of all types shall have no exposed live binding posts or contacts. This does not apply to the heating element.

RECEPTACLES NEAR FLOOR.

Receptacles located within 30 inches of the floor shall be of the protected contact type. Receptacles of a type having Edison bases, and receptacles having bare contacts when the attachment plug is removed, will not be approved unless located more than 30 inches from the floor.

KNIFE SWITCHES.

Knife switches, except on panelboards and switchboards, shall be of the safety inclosed type. See article 1202 c.

AUTOMATIC SWITCHES.

Automatic switches may be inclosed in standard cabinets with hinged doors.

EDISON PLUG CUTOUTS.

Edison plug cutouts, except those used in connection with safety switches, shall be of the dead front or safety type. See article 801 b.

STRIP FUSES.

Strip and link fuses will not be approved. All fuses shall be of the plug or cartridge type. See article 802.

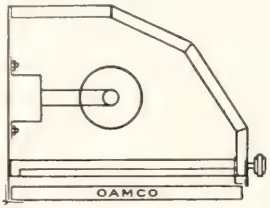
CABINETS.

Where devices are placed in metal cabinets, such cabinets shall comply with the specifications on cutout cabinets and boxes.

ENFORCEMENT OF RULES.

It is the intent of these rules to ultimately obtain from the manufacturer a class of apparatus which in its inherent design will provide the protection sought. In most cases this very desirable protection from both accident and fire can be obtained without any material increase in the cost of production. The department will, in obtaining a strict compliance with the provisions of the rule, extend every warranted concession, but it requests and expects the active co-operation of all concerned.

The rules will be enforced on all new installations and applies to all apparatus, except as noted below, whether the apparatus being installed is new or used. Where apparatus is moved from one location to another within the same building and for the same owner, or where a concern moves from one location to another, this rule shall not apply, provided the apparatus has been previously approved by the department and is in good condition. On new installations, used apparatus, other than that exempted above, shall be remodeled to comply, as far as practicable, with these rules before being again placed in use.



Bank Screen

(R-L-M) Standard

PORCELAIN ENAMELED STEEL REFLECTORS

Types: (R-L-M) Standard, Shallow Bowl, Deep Bowl, and Angle, for illumination of mills, machine shops, garages, etc.

PAINT ENAMELED TIN REFLECTORS

SHOW CASE REFLECTORS

WALL CASE REFLECTORS

PICTURE REFLECTORS

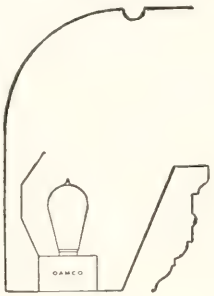
BANK SCREEN REFLECTORS
For Lighting Bank Cages

COVE REFLECTORS
For Indirect Lighting

THEATRE REFLECTORS
Foot Lights, Border, Proscenium Strips

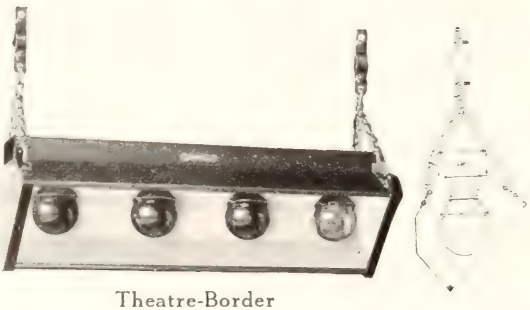
GAS AND VAPOR-PROOF FIXTURES

WEATHERPROOF FIXTURES



Cove

Foot Light



Theatre-Border

OVERBAGH & AYRES MFG. CO.

411 S. Clinton Street

CHICAGO, ILL.

ELECTRICAL INFORMATION, DEPARTMENT OF ELECTRICITY CITY OF CHICAGO

Exit Sign Lights and Emergency Lighting Systems, as Required by Ordinances of the City of Chicago.

Apartment buildings (3 stories or more in height) VI	None	
Apartment hotels (20 or more persons and more than 2 stories high) IIb	A-2-	C
Asylums (more than 10 persons and more than 2 stories high) IIc	A-2	C
Assembly halls IVb	A-1	E-1 and E-2
Banquet halls IVb	A-1	E-1 and E-2
Billiard rooms and bowling alleys IVb	A-1	E-1 and E-2
Churches IVa	A-1	E-2
Club houses (less than 20 persons and more than 4 stories high) IIa	A-2	B
Club houses (20 or more persons and more than 2 stories high) IIb	A-1	C
Dance halls IVb	A-1	E-1 and E-2
Department stores (more than 2 stories high) VII	A-2	B*
Dwellings III	None	None
Expositions IVb	A-2	E-1 and E-2
Factories (more than 2 stories high) I	A-2	B
Garage (more than 2 stories high)	A-2	B**
Gymnasiums (if sleeping accommodations for 20 persons or more, and more than 2 stories high) IIb	A-2	C
Gymnasiums (in buildings containing no assembly hall) IVb	A-1	E-1 and E-2
Gymnasiums (in buildings containing assembly halls)	None	None
Homes for Aged or Children (more than 10 persons and more than 2 stories high) IIc	A-2	C
Hospitals (more than 10 persons and more than 2 stories high) IIc	A-2	C
Hotels (20 or more persons and more than 2 stories high) IIb	A-2	C
Infirmaries (more than 10 persons and more than 2 stories high) IIc	A-2	C
Jails (more than 10 persons and more than stories high) IIc	A-2	C
Libraries (more than stories high) IIa	A-2	B
Lodge halls IVb	A-1	E-1 and E-2
Lodging houses (20 or more persons and more than 2 stories high) IIb	A-2	C
Moving picture theatres —(See Theatres)		
Office buildings (more than 4 stories high) IIa	A-2	B
Parish halls IVb	A-1	E-1 and E-2
Police stations (mor than 10 persons and more than 2 stories high) IX	A-2	B
Residences III	None	None
Rooming houses (20 or more persons and more than 2 stories high) IIb	A-2	C
Skating rinks IVb	A-1	E-1 and E-2
Schools (more than 100 students) VIII	A-2	C
School halls (in school buildings) VIII	A-1	C
School halls (in separate buildings) IVb	A-1	E-1 and E-2
Stables (more than 2 stories high)	A-2	B**
Stores (other than department stores, more than 3 stories high) I	A-2	B
Theatres (regular theatres), V	A-1	C
Theatres (not more than two sets of scenery and not more than 300 seats) IVb	A-1	C
Theatres (not more than two sets of scenery and more than 300 seats) IVb	A-1	C
Theatres (moving picture theatres with not more than 300 seats) IVc	A-1	C
Theatres (moving picture theatres with more than 300 seats) IVc	A-1	C
Warehouses 1	None	None

NOTE.—Any floor 6 inches below the surface level is considered as a basement.

(A-1) Emergency lighting system of electricity in all halls, corridors, stairways or other means of exit, which shall be independent of all other lights. Separate meter and service switch and, on overhead services, separate service to outside of buildings. Lights to be controlled only in lobby. Lights shall be kept burning until audience has left building.

(A-2) Emergency lighting system of electricity in all halls, corridors, stairways or other means of exit, which shall be independent of all other lights. Separate meters, and service switches, but service may be connected to mains inside of building. Lights shall be controlled only at some point near the main entrance. Lights shall be kept burning until the occupants have left the building.

NOTE.—Emergency lighting system shall be electric where electricity is used for general illumination.

(B) Exit signs illuminated by gas or electric light.

(C) Exit signs illuminated by gas only. (Electric not permitted.)

(E-1) Where auditorium is used for theatricals, whether regularly or occasionally, exit signs shall be illuminated by gas.

(E-2) Where not used for theatricals and where the seating capacity is not more than 400, exit signs shall be illuminated by gas or electricity. Where the seating capacity is more than 400, exit signs shall be illuminated by gas.

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*Illuminated signs shall be provided showing the number of the floor.

**Any building more than 2 stories high having a garage or stable on the first floor, exit signs shall be illuminated by electricity; gas not permitted.

* Where single conductor, single braid, solid wires only, are used, four No. 14 wires may be installed in a ½ inch conduit and up to seven No. 14 wires in a ¾ inch conduit. Three No. 12 wires may be installed in a ½ inch conduit, four No. 10 wires in a ¾ inch conduit and three No. 8 wires in a ¾ inch conduit.

A complete line of steel, fire enameled reflectors for all industrial purposes—

No. 2616

Skirted Bowl—Green Outside and White Inside

No.	Dia.	Socket	Watts
2612	12″	Std.	75
2614	14″	Std.	100-150
2616	16″	Std.	200
2616½	16″	Mogul	300
2618½	18″	Mogul	300-500

No. 1216

Shallow Bowl—Green Outside and White Inside

No.	Dia.	Socket	Watts
1212	12″	Std.	25- 75
1214	14″	Std.	60-100
1216	16″	Std.	100-150
1218	18″	Std.	150-250
1218½	18″	Mogul	300-500

No. 1118

Flat Cone—Green Outside and White Inside

No.	Dia.	Socket	Watts
1114	14″	Std.	25- 75
1116	16″	Std.	60-100
1118	18″	Std.	150-250
1120	20″	Std.	250
1120½	20″	Mogul	400-1000

No. 310

Anglelite—Green Outside and White Inside

For Show Windows and Sign Boards. Unbreakable, efficient, easily cleaned and inexpensive.

No.	Dia.	Socket	Watts
310	10″	Std.	40- 60
312	12″	Std.	100-150
314	14″	Std.	250
314½	14″	Mogul	300

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1850-1858 Fulton Street

Telephones Seeley 2430-1-2

ALLOWABLE CARRYING CAPACITIES OF WIRES

B. & S. Gage	Diam. of Solid Wires in Mils	Area in Circular Mils	Table A Rubber Insulation Amperes	Table C Other Insulation Amperes
18	40 3	1,624	3	5
16	50 8	2,583	6	10
14	64 1	4,107	15	20
12	80 8	6,530	20	25
10	101 9	10,380	25	30
8	128 5	16,510	35	50
6	162 0	26,250	50	70
5	181.9	33,100	55	80
4	204 3	41,740	70	90
3	229 4	52,630	80	100
2	257 6	66,370	90	125
1	289 3	83,690	100	150
0	325	105,500	125	200
00	364:8	133,100	150	225
000	409 6	167,800	175	275
		200,000	200	300
0000	460.	211,600	225	325
		250,000	250	350
		300,000	275	400
		350,000	300	450
		400,000	325	500
		500,000	400	600
		600,000	450	680
		700,000	500	760
		800,000	550	840
		900,000	600	920
		1,000,000	650	1,000
		1,100,000	690	1,080
		1,200,000	730	1,150
		1,300,000	770	1,220
		1,400,000	810	1,290
		1,500,000	850	1,360
		1,600,000	890	1,430
		1,700,000	930	1,490
		1,800,000	970	1,550
		1,900,000	1,010	1,610
		2,000,000	1,050	1,670

1 mil = 0.001 **inch.**

SIZE OF CONDUIT FOR THE INSTALLATION OF WIRES AND CABLES RUBBER COVERED WIRES

Size of Wire	Number of Wires in One Conduit								
	1	2	3	4	5	6	7	8	9
	Minimum Size of Conduit in Inches								
14	½	½	½	•¾	¾	1	•1	1	1
12	½	½	•¾	¾	¾	1	1	1	1¼
10	½	¾	¾	•1	1	1	1¼	1¼	1¼
8	½	¾	•1	1	1	1¼	1¼	1¼	1¼
6	½	1	1¼	1¼	1½	1½	2	2	2
5	¾	1¼	1¼	1¼	1½	2	2	2	2
4	¾	1¼	1¼	1½	2	2	2	2	2½
3	¾	1¼	1¼	1½	2	2	2	2½	2½
2	¾	1¼	1½	1½	2	2	2½	2½	2½
1	¾	1½	1½	2	2	2½	2½	3	3
0	1	1½	2	2	2½	2½	3	3	3
00	1	2	2	2½	2½	3	3	3	3½
000	1	2	2	2½	3	3	3	3½	3½
0000	1¼	2	2½	2½	3	3	3½	3½	4
200000C.M.	1¼	2	2½	2½	3	3	3½	3½	4
225000	1¼	2½	2½	3	3	3½			
250000	1¼	2½	2½	3	3	3½			
300000	1¼	2½	3	3	3½	3½			
350000	1¼	2½	3	3½	3½	4			
400000	1¼	3	3	3½	4	4			
450000	1½	3	3	3½	4	4½			
500000	1½	3	3	3½	4	4½			
550000	1½	3	3½	4	4½	5			
600000	2	3	3½	4	4½	5			
650000	2	3½	3½	4					
700000	2	3½	3½	4½					
750000	2	3½	6½	4½					
800000	2	3½	4	4½					
850000	2	3½	4	4½					
900000	2	3½	4	4½					
950000	2	4	4	5					
1000000	2	4	4	5					
1100000	2½	4	4½	6					
1200000	2½	4½	4½	6					
1250000	2½	4½	4½	6					
1300000	2½	4½	5	6					
1400000	2½	4½	5	6					
1500000	2½	4½	5	6					
1600000	2½	5	5	6					
1700000	3	5	5	6					
1750000	3	5	5	6					
1800000	3	5	6	6					
1900000	3	5	6						
2000000	3	5	6						

Note.—Nos. 14 to 8, solid wires, all others stranded. Outside diameters are given as wires of different makes vary in the outside diameters of similar sizes. This table is based on runs of fifty feet and not more than two standard right angle elbows. Where there are no elbows, or where manufactured bends of a radius greater than the standard elbow are used, special permission in writing may be granted for a deviation from the above table.

WIRES IN CONDUIT.—For combinations of wires not shown in the Chicago Electrical Code, the following tables may be used to determine the proper size conduit. The combined area of the wires should never exceed 40 per cent. of the area of the conduit. This table must only be used where there are more than three wires in the conduit. Special permission must be obtained for the installation of more wires than are shown in Table headed "Number of Wires in Conduit."

Support of Wires in Vertical Conduits.

Wires in vertical conduits shall be supported at the following intervals:

		not greater than
No .14	to No. 0	....100 ft.
No. 00	to No. 0000	.... 80 ft.
No. 0000	to 350000 C. M.	.... 60 ft.
350001 C. M.	to 500000 C. M.	.... 50 ft.
500001 C. M.	to 750000 C. M.	.... 40 ft
Above 750000 C. M.		.... 35 ft.

The following methods of supporting cables are recommended:

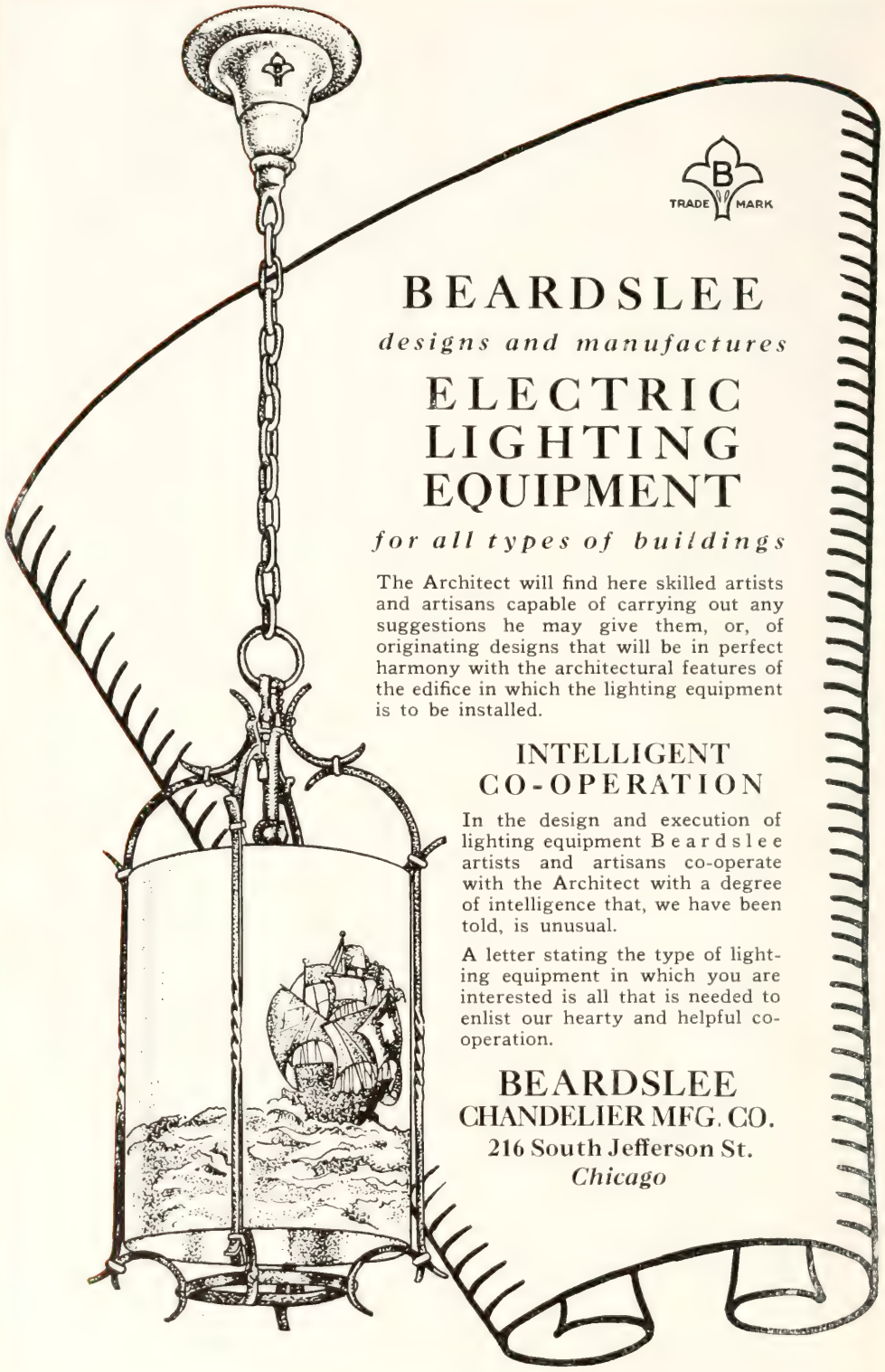
1. By approved clamping devices constructed of or employing insulating wedges inserted in the ends of the conduits.

2. By inserting junction boxes at the required intervals in which insulating supports of approved type are installed and secured in a satisfactory manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

3. In approved junction boxes, by deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, the cables being carried on two or more insulating supports, and additionally secured thereto by the wires if desired.

Size of Ground Wire and Size of Ground Conduit for Grounding Circuit.

Size of Largest Wire	Size of Ground Wire	Size of Ground Conduit
10	10	½ inch
8	8	½ inch
6	8	½ inch
4	8	½ inch
3	8	½ inch
2	8	½ inch
1	8	½ inch
0	8	½ inch
00	8	½ inch
000	8	½ inch
0000	6	½ inch
300,000	4	¾ inch
400,000	4	1 inch
500,000	3	1 inch
600,000	2	1 inch
700,000	1	1¼ inch
800,000 and above	0	1¼ inch



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WHERE ALLOWED BY SPECIAL PERMISSION

Size of Wire	Maximum Number of Wires in Conduit					
	Inch 1	Inch 1¼	Inch 1½	Inch 2	Inch 2½	Inch 3
14	11	19	26	43	61	95
12		15	21	34	50	77
10		12	16	27	38	60
8			13	22	31	49
6					14	22

SIZE OF CONDUIT FOR THE INSTALLATION OF WIRES AND CABLES

Lead Covered Wires (0-600 Volts) (Single Conductors)

Size of Wire	Outside Diam 64th	Diam Dec Equiv.	Number of Conductors in One Conduit — Minimum Size of Conduit in Inches: 1	2	3	4
14	18	.281	½	¾	¾	1
12	20	.312	½	¾	1	1
10	23	.359	½	1	1	1¼
8	25	.39	½	1	1¼	1¼
6	30	.47	¾	1¼	1¼	1½
5	32	.50	¾	1¼	1¼	1½
4	33	.51	¾	1¼	1½	2
3	35	.55	¾	1½	1½	2
2	37	.58	1	1½	2	2
1	41	.64	1	2	2	2½
1/0	44	.68	1	2	2	2½
2/0	47	.73	1	2	2	2½
3/0	50	.78	1¼	2	2½	3
4/0	54	.84	1¼	2½	2½	3
250,000	62	.97	1¼	3	3	3½
300,000	65	1.01	1½	3	3	3½
350,000	68	1.06	1½	3	3	3½
400,000	71	1.11	1½	3	3½	4
450,000	74	1.15	1½	3	3½	4
500,000	78	1.21	2	3½	3½	4
550,000	86	1.34	2	3½	4	4½
600,000	88	1.37	2	3½	4	4½
650,000	90	1.40	2	4	4	5
700,000	92	1.43	2	4	4	5
750,000	94	1.47	2	4	4	5
800,000	96	1.50	2½	4	4½	5
850,000	99	1.55	2½	4	4½	5
900,000	100	1.56	2½	4	4½	5
950,000	102	1.59	2½	4½	4½	6
1,000,000	105	1.64	2½	4½	4½	6
1,250,000	116	1.81	3	5	5	6
1,500,000	126	1.97	3	5	6	
1,750,000	136	2.12	3	6	6	
2,000,000	142	2.21	3	6	6	

Dimensions of Rubber-Covered Wire.

Wire	Area	Wire	Area	Wire	Area
14	.031	225,000 C.M.	.55	1,000,000 C.M.	1.74
12	.038	250,000 C.M.	.58	1,100,000 C.M.	2.04
10	.049	300,000 C.M.	.69	1,200,000 C.M.	2.16
8	.06	350,000 C.M.	.77	1,250,000 C.M.	2.22
6	.13	400,000 C.M.	.83	1,300,000 C.M.	2.27
5	.15	450,000 C.M.	.92	1,400,000 C.M.	2.40
4	.17	500,000 C.M.	.99	1,500,000 C.M.	2.52
3	.19	550,000 C.M.	1.11	1,600,000 C.M.	2.63
2	.21	600,000 C.M.	1.19	1,700,000 C.M.	2.78
1	.27	650,000 C.M.	1.27	1,750,000 C.M.	2.85
0	.31	700,000 C.M.	1.33	1,800,000 C.M.	2.89
00	.36	750,000 C.M.	1.39	1,900,000 C.M.	3.05
000	.42	800,000 C.M.	1.45	2,000,000 C.M.	3.14
0000	.49	850,000 C.M.	1.54		
		900,000 C.M.	1.60		
		950,000 C.M.	1.68		

Dimensions of Conduit.

Conduit	Area	40% of Area	Conduit	Area	40% of Area
½	.306	.122	3	7.34	2.93
¾	.516	.206	3½	9.94	3.97
1	.848	.339	4	12.7	5.08
1¼	1.49	.596	4½	15.9	6.36
1½	2.03	.812	5	19.9	7.96
2	3.32	1.328	6	28.8	11.52
2½	4.75	1.9			

Example: What size conduit is required for 6 No. 6 and 4 No. 2, B. & S. gage R. C. wires? 6 x .13 = .78, 4 x .21 = .84, or a total area of 1.62. In the column headed "40% of Area" it will be found that a 2½" conduit is required.

DIRECT CURRENT MOTORS—110 VOLTS. SIZE OF WIRE FOR BRANCHES OR MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Size of Fuse	Size of Switch
1	8	14	½	10	30
2	15	12	½	20	30
3	23	8	¾	30	30
4	30	6	1	40	60
5	38	6	1	50	60
7.5	56	4	1¼	70	100
10	75	1	1½	95	100
12.5	94	0	1½	120	200
15	113	00	2	150	200
17.5	131	000	2	175	200
20	150	0000	2	200	200
		c. m.			
25	188	250	2½	250	400
30	225	300	2½	300	400
35	263	400	3	325	400
40	300	500	3	375	400
45	338	600	3	425	600
50	375	700	3½	475	600
55	413	800	3½	525	600
60	450	800	3½	575	600
65	488	900	3½	600	800
70	525	1000	4	650	800
75	563	1100	4	700	800
80	600	1300	4½	750	800
85	638	1400	4½	800	800
90	675	1500	4½	850	1000
95	713	1600	5	900	1000
100	750	1700	5	950	1000
125	938	2- 900	2-3½	1175	1200
150	1125	2-1100	2-4	1400	1500
200	1500	2-1700	2-5	1875	†C. B.
250	1875	3-1300	2-5	2350	C. B.
300	2250	3-1700	2-5	2800	C. B.

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

Double-pole switches over 1500 amperes not permitted. Circuit-breakers or oil switches must be used.

Fuses must not be larger than 125% of motor rating.

Where fuses larger than 600 amperes are required fuses may be used in multiple. The least possible number of fuses must be used in such cases and the fuses must be of equal capacity.

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DIRECT CURRENT MOTORS—220 VOLTS. SIZE OF WIRE FOR BRANCHES OR MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Size of Fuse	Size of Switch
1	4	14	½	5	30
2	8	14	½	10	30
3	12	14	½	15	30
4	15	12	½	20	30
5	19	10	¾	25	30
7.5	28	8	¾	35	60
10	38	6	1	50	60
12.5	47	4	1¼	60	60
15	56	4	1¼	70	100
17.5	65	3	1¼	80	100
20	75	1	1½	95	100
25	94	0	1½	120	200
30	113	00	2	150	200
35	131	000	2	175	200
40	150	0000	2	200	200
45	169	0000	2	225	400
50	188	c. m. 250	2½	250	400
55	206	300	2½	250	400
60	225	300	2½	300	400
65	244	350	2½	300	400
70	263	400	3	325	400
75	281	500	3	350	400
80	300	500	3	375	400
85	319	500	3	400	400
90	338	600	3	425	600
95	356	600	3	450	600
100	375	700	3½	475	600
125	463	900	3½	575	600
150	563	1100	4	700	800
200	750	1700	5	950	800
250	938	2- 900	2-3½	1175	1200
300	1125	2-1100	2-4	1400	1500

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

Fuses must not be larger than 125% of motor rating.

Where fuses larger than 600 amperes are required, fuses may be used in multiple. The least possible number of fuses must be used in such cases and the fuses must be equal in capacity.

THREE-PHASE MOTORS—220 VOLTS. SIZE OF WIRE FOR BRANCHES OR MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Running Fuse	Starting Fuse	Motor Switch	Service Switch
1	3	14	½	10	10	30	30
2	6	14	½	10	20	30	30
3	9	14	½	15	30	30	30
5	13	12	½	20	40	30	60
7½	19	10	¾	30	60	30	60
10	26	8	¾	40	65	60	100
15	38	6	1¼	50	80	60	100
20	51	4	1¼	70	100	100	100
25	64	3	1¼	80	125	100	200
30	77	1	1½	100	150	100	200
35	90	0	2	125	200	200	200
40	102	00	2	150	200	200	200
45	115	00	2	150	250	200	400
50	128	000	2	175	250	200	400
55	141	000	2	200	300	200	400
60	154	0000	2½	200	300	200	400
65	166	0000	2½	225	350	200	400
70	179	0000	2½	225	350	400	400
75	192	250	2½	250	400	400	400
80	205	300	3	275	425	400	600
85	218	300	3	275	450	400	600
90	230	350	3	300	475	400	600
95	243	350	3	325	500	400	600
100	256	400	3	325	500	400	600
125	320	500	3	400	650	400	800
150	384	700	3½	500	750	600	800
200	512	2-400	2-3	650	1025	800	1200
250	640	2-500	2-3	800	1300	800	1500
300	768	2-700	2-3½	1000	1550	1000	1500

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

This table is figured on a basis of 85% power factor and 90% efficiency, or 2.56 amperes per horsepower. Motors of horsepowers not shown in the table may be calculated on this basis allowing 25% overload for circuits supplying one motor.

The motor switch must not be smaller than 125% of the rating of the motor. Running fuses must not be larger than 125% of the rated current of the motor and starting fuses of a capacity of 300% of the rated current for motors of 1 to 5 horsepower, 250% for motors from 6 to 10 horsepower and 200% for motors above 10 horsepower will be permitted.

THREE-PHASE MOTORS—440 VOLTS. SIZE OF WIRE FOR BRANCHES OR MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Running Fuse	Starting Fuse	Motor Switch	Service Switch
1	2	14	½	5	10	30	30
2	3	14	½	5	10	30	30
3	4	14	½	10	15	30	30
5	6	14	½	10	20	30	30
7½	9	14	½	15	30	30	30
10	13	12	½	20	35	30	60
15	19	10	¾	25	50	80	60
20	25	8	¾	35	65	60	100
25	32	6	1¼	40	65	60	100
30	38	6	1¼	50	75	60	100
35	45	4	1¼	60	90	60	100
40	51	4	1¼	65	100	100	100
45	57	4	1¼	75	110	100	200
50	64	3	1¼	80	125	100	200
55	70	2	1½	90	150	100	200
60	77	1	1½	95	150	100	200
65	83	0	2	100	175	100	200
70	89	0	2	110	200	200	200
75	96	0	2	125	200	200	200
80	102	00	2	125	200	200	200
85	109	00	2	150	225	200	400
90	115	00	2	150	225	200	400
95	121	000	2	150	250	200	400
100	128	000	2	175	250	200	400
125	160	000	2	200	325	200	400
150	192	250 c m	2½	250	375	400	400
200	256	400 c m	3	325	500	400	600
250	320	500 c m	3	400	650	400	800
300	384	700 c m	3½	475	775	600	800

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

This table is figured on a basis of 85% power factor and 90% efficiency, or 1.28 amperes per horsepower. Motors of horsepowers not shown in the table may be calculated on this basis, allowing 25% overload for circuits supplying one motor.

The motor switch must not be smaller than 125% of the rating of the motor. Running fuses must not be larger than 125% of the rated current of the motor and starting fuses of a capacity of 300% of the rated current for motors of 1 to 5 horsepower, 250% for motors from 6 to 10 horsepower and 200% for motors above 10 horsepower will be permitted.

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Estimates Cheerfully Submitted

MOTORS—SIZE OF WIRES FOR MAINS. THIS TABLE GIVES MAXIMUM HORSE-POWER ALLOWED ON VARIOUS SIZES OF WIRES.

Size of Wire	Size Conduit Main 2 Wire	Direct Current Maximum H. P. 110 V.	Direct Current Maximum H. P. 220 V.	Size Conduit 3 Wires	Three Phase Maximum H. P. 220 V.	Three Phase Maximum H. P. 440 V.
14	½	2	4	½	6	12
12	½	2.7	5.3	½	8	16
10	¾	3.3	6.7	¾	10	20
8	¾	4.7	9.3	¾	14	27
6	1	6.7	13.3	1¼	20	39
4	1¼	9	19	1¼	27	55
3	1¼	11	21	1¼	31	62
2	1¼	12	24	1½	35	70
1	1½	13	27	1½	39	78
0	1½	17	33	2	49	97
00	2	20	40	2	59	117
000	2	23	47	2	68	137
0000	2	30	60	2½	88	176
250,000	2½	33	67	2½	97	195
300,000	2½	37	73	3	108	216
350,000	2½	40	80	3	117	234
400,000	3	43	87	3	127	254
500,000	3	53	106	3	156	312
600,000	3	60	120	3½	176	352
700,000	3½	67	133	3½	195	390
800,000	3½	73	147	4	215	430
900,000	3½	80	160	4	234	468
1,000,000	4	87	173	4	254	508
1,100,000	4	92	184	4½	269	539
1,200,000	4½	97	195	4½	285	570
1,300,000	4½	103	205	5	301	602
1,400,000	4½	108	216	5	316	633
1,500,000	4½	113	227	5	332	664
1,600,000	5	119	237	5	348	695
1,700,000	5	124	248	5	363	727
1,800,000	5	129	259	6	378	757
1,900,000	5	135	269	6	394	789
2,000,000	5	140	280	6	410	820

In calculating the size of mains, where any individual motor has a horsepower of 50% or more of the total connected load, the 25% overload must be allowed for such motor. Example: In a total connected load of 100 horsepower there is one 50-horsepower motor and a number of smaller motors totaling 50 horsepower; 25% overload for the 50-horsepower motor gives the equivalent of 62½ horsepower which, added to the remaining load of 50 horsepower, gives a total of 112½ horsepower to be provided for. On a 220-volt, 3-phase system this would require a 350,000 C. M. conductor.

SIZE OF WIRES FOR SINGLE-PHASE MOTORS.

	110 Volts		220 Volts	
Horse Power	Full Load Current	Size of Wire	Full Load Current	Size of Wire
1	12	12	6	14
2	23	8	11	12
3	33	6	16	10
4	44	4	22	8
5	53	3	26	6

SIZE OF WIRES FOR SYNCHRONOUS MOTORS.

(THREE-PHASE.)

MOTORS OF 100 HORSEPOWER OR LARGER.

AMPERES PER HORSEPOWER.

220 Volts		440 Volts	
One Motor	Mains	One Motor	Mains
3.0	2.4	1.5	1.2

These values are calculated on a basis of 90% power factor, 90% efficiency and 25% overload for single motors.

BUILDING CODE REQUIREMENTS FOR LIVE LOAD IN VARIOUS CITIES

In Pounds Per Square Foot

STRUCTURE	Baltimore	Boston	Buffalo	Chicago	Cincinnati	Indianapolis	Milwaukee	Minneapolis	New Orleans	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco	Seattle	Washington
Apartments	60	50	70	40	40	50	30	50	40	...	70	...	50	60	40	50
Assembly Halls	...	...	100	100	100	125	...	125	...	100	120	150	100	...	...	...
Dwellings	60	50	40	40	40	50	30	50	40	40	70	70	50	60	40	50
Hospitals	...	...	70	50	...	50	30	50	...	...	70	...	50	60	50	...
Hotels	60	...	70	50	40	75	30	50	40	...	70	...	50	60	40	50
Manufacturing	175	...	...	...	150	200	...	...	...	...	150	200	150	250	...	...
Light Manufacturing	125	125	120	100	100	100	100	100	125	...	120	...	100	125	125	...
Heavy Storehouses	250	250	...	...	150	200	...	...	...	...	150	...	...	250	...	150
Warehouses	...	250	150	...	150	200	...	...	200	...	150	200	150	250	...	150
Offices	75	100	70	50	50	75	40	75	70	60	100	...	60	60	50	75
Schools—Class Rooms	75	60	...	...	60	100	40	100	60	75	...	...	75	75	50	75
Stairways, General	...	70	...	100	80	...	60	...	70	...	...	...	...	...	100	...
Roofs—Slope Under 20°	...	40	40	25	25	30	30	50	30	40	30	50	30	30	40	25
Wind Pressure	30	...	30	20	20	...	30	30	...	30	30	...	30	20	...	30

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OF
COMMONWEALTH EDISON CO.

STANDARD FORMS OF SERVICE.

1. The Company's standard service for light and power is available in different forms, the kind of service available depending upon the locality and the amount of energy required, as follows:

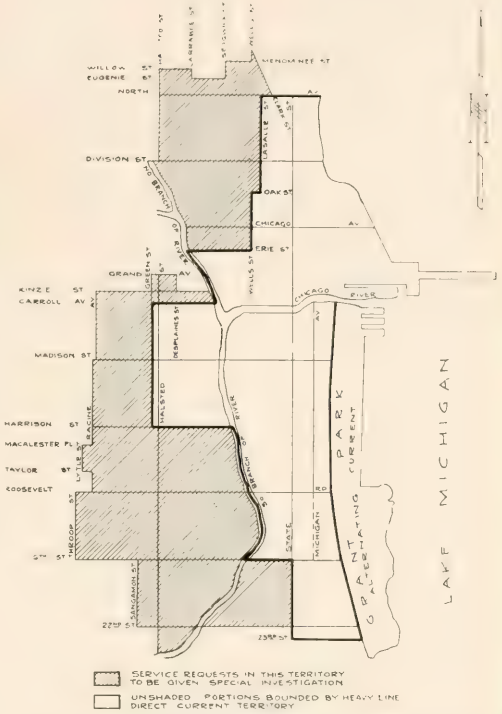
2. Direct current, 3-wire, low tension Edison service at approximately 115-230 volts, available for light and power, only within the district boundaries shown on the map on next page. On any installation coming with the shaded portions, or close to the boundary lines of these portions, the customer must consult the Distribution Division of the Company, in order to ascertain the kind of service available, as these shaded territories are at present being served partially from direct current system but are being changed to alternating current service as rapidly as the company's lines can be extended. This consultation is also necessary because near the boundaries, direct and alternating current lines overlap in some places, and, in addition, the boundary lines are from time to time subject to change.

3. Alternating current, sixty cycle, single phase, 3-wire, low tension, transformed service, approximately 115-230 volts, is available for light and power (5 H. P. or less) outside of the boundaries of the direct current district, where the Company has single phase mains.

4. Where the Company has 3-phase mains, alternating current, sixty cycle, 3-phase, 3-wire, low tension transformed service, at approximately 230 volts, is available for power service for motors of 5 H. P. and larger, 3-phase service, at approximately 460 volts, will be furnished upon request for power installations having an aggregate rated motor capacity of 250 H. P. or more..

5. Under special conditions, other voltages on the alternating current, 60-cycle system are available, information regarding which may be had upon application to the Company.

6. When service is desired at locations where the Company has no lines or where its lines are not suitable for the class of service desired, a line extension must be arranged for. In such cases the Company will, upon receipt of advice as to the class of service and amount of energy desired, have an estimate prepared of the cost of installing the necessary line extension. If the estimated cost of the proposed line extension is in excess of the cost of a "free extension" as provided by the rules of the Illinois Commerce Commission, the excess cost of the extension must be deposited with the Company by the applicant or applicants.



7. **The Company will not be responsible for mistakes of any kind whatsoever which may result from information given orally on the character of its service or the location of its main, unless such information is confirmed in writing.**

SERVICE CONNECTIONS.

Overhead.

2. The Company will provide at its own expense, for any customer, one overhead service drop for light and, where required by these rules, one overhead service drop for power. The length of this service drop shall in no case exceed 115 feet. Where the length of the service drop exceeds the amount allowed by the Company, a pole must be provided for each 110 feet or fraction thereof, provided, however, that where, due to special conditions, such a span is impossible, single spans between poles may be increased to 125 feet in length. The pole must be of cedar, at least 25 feet in length, with a minimum diameter of 6 inches at the top and set in the ground at least 4½ feet. A square timber will not be approved as an intermediate support in place of a pole.

If, in order to give a better appearance, a steel pole is desired, this should be a two-section tubular steel pole, made up of two

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lengths of standard steel tubing, having nominal diameters of 4 in. and 5 in. The tubes should be joined by a swedge joint. Where the length of the service drop and the service conductors are 3 No. 6 wires or less a single piece of 4-inch standard pipe 20 feet long may be used. These poles must be set in a concrete collar, at least 12 inches in diameter. At the top of the pole, drillings are to be made and a standard spool-type bracket must be mounted in the proper position. This bracket is to be 2 or 3 wire, depending on the character of the customer's installation.

The requirements in the above paragraphs refer to the installation of service connections which do not require a service in excess of the excess of 6 No. B. & S. gauge wires. On installations requiring a service in excess of the above, the Distribution Division of the Company must be consulted for specifications covering the length of spans between poles and the size of poles.

4. Service outlets should never be more than thirty (30) feet nor less than ten (10) feet from the ground. For buildings of two or more stories in height, the outlet should be brought out at the ceiling of the second floor.

6. Risers used for the support of service wires are objectionable and should be used only in such cases where their use cannot be avoided. A riser must be of clear, sound straight-grained fir or cypress or equally strong material to conform to the rules of the Department of Gas and Electricity of Chicago.

8. Where a one story building is located on the alley lot line, the service, if brought out on the alley side of the building, will not clear the telephone wires if the pole is located on the same side of the alley as the building and will not give the required 18 ft. clearance over the alley (see paragraph 12 (c) if the pole is located in the opposite side of the alley. For this reason, the Department of Gas and Electricity of Chicago will permit a variation from the standard rule requiring services brought to the alley side of the building. On such one story buildings, the service should be brought out on that part of the building farthest from the alley, but in no case must the service outlet be more than 15 feet from the alley line. The service outlet should be placed on the same side of the building as the pole so that the service drop will extend away from the building and not over it. Where a pole is located directly back of a building of the above type, the service outlet, if located away from the alley side of the building, wil in some cases, eliminate the necessity of conduit being carried down the pole. The above modification of the rule of the Department of Gas and Electricity of Chicago only applies to one story buildings and will, in many cases, avoid the use of objectionable risers. In many cases, risers and the installing of wires down a pole may be avoided by connecting a rear building to the service drop installed for a front building. In such cases, the customer must install weatherproof wire between the rear building and the front building, but the final connection on the front building service will be made by the Company.

9. Service outlets must not be located on chimney or on fire parapet walls extending above a roof.

10. Service outlets must never be terminated within 1 foot of a down spout which is located on a porch post or porch support.

11. Where a service outlet is terminated on a post supporting a porch, galvanized steel straps or braces must be fastened in such a manner that the post will be firmly held to the joist. Each strap must be at least 1 in. x 12 in. and ⅛ in. in thickness, and must be fastened to the post and joist by lag screws, 2 into the post and 2 into the joist, such lag screws to be ¼ in. x 2½ in. Two straps must be used, one on each side of the post.

12. Where wiring is being installed in buildings under construction which are to have a stucco or stone-coat finish, a substantial form of support for the service bracket must be provided, this support to consist of a 2 in. x 8 in. x 24 in. piece of timber projecting beyond the finish of the building and securely fastened to the studding of frame buildings or by hooks through the wall of brick or tile structures.

Instead of a timber, galvanized eye bolts, having a minimum diameter of ⅜ in., spaced 8 in. apart, may be used, the eye portion of the bolts to extend at least 2 in. beyond the surface of the building. When bolts are used for the support of a timber or the service, they must extend through, and be anchored on the inside surface of the wall, to a substantial metal plate, not less than $\frac{5}{16}$ in. in thickness and having at least 4 square feet of bearing surface on the inside wall of the building.

The length of service mains to be brought outside of the service outlet and the method of fastening service wires to a building for No. 4/0 service connection and larger, and the method to be used for attachment of service connection for stucco or tile buildings.

13. Clearances.

(a) The service wires must, in no case, be within easy reach from porches, windows, or any other part of the building ordinarily accessible to the occupants.

(b) The service outlet must be so located that there will be at least 24 inches' clearance between it and any telephone or signal wires where attached to the building, and at least 36 inches' clearance must be provided between the service drops of both systems in the open span, in accordance with the rules of the Department of Gas and Electricity of Chicago.

(c) When the Company's pole line is on the opposite side of the street or alley from that of the building to which service is to be given, the service outlet for such a building must be of sufficient height to give at least an 18 ft. clearance between any point of the street or alley and the service drop.

Underground.

1. Where the space beneath the sidewalk is excavated, the service cables will be terminated at a point about 3 feet inside the curb wall. Service mains installed by the customer must be brought to the nearest service entrance, if there be one within 50 feet of his premises.

2. Where there is no service available, application should be made to the Contract Department of the Company to have service installed.

3. Where there is no sidewalk excavation and where there is a basement at the property line, the service cables will be terminated at a point about 3 feet inside the basement wall.

4. Where no basement is available at the property line, the service will be extended underground, at the customer's expense, from the property line to any point designated, but in no case will the service be terminated in any place which is likely to be used for coal storage.

5. In case the customer does not wish to bear the expense o fan underground service across his property, the underground service will be brought up on a pole at the lot line, provided the Companys underground mains are available in the rear of the customer's premises. The poles and the overhead serv-

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ice to the building will be installed at the customer's expense, unless the customer will permit the Company to use the pole to supply other customers.

6. On account of obstacles that are frequently met with in the street, it is impossible for the Company to determine in advance the exact location at which the service cables will enter the building. Because of this uncertainty, the service-switch cabinet should not be installed until after the Company has completed the laying of the service duct or pipe into the building.

7. Where the service cables are to supply not more than one set of building mains, the service-switch cabinet must be installed by the customer and located at the service stub in such a manner that the cables will be entirely enclosed. If this is not practicable, a junction-cabinet not less than 15 inches in length, 12 inches in width, and 6 inches in depth for No. 6 cable must be installed by the customer over the underground pipe and enclosing the Company's service cables. This cabinet must be provided with a cover fastened in place with screws. Conduit must be installed by the customer to connect the junction-cabinet with the service-switch cabinet. Where the Company's service mains are larger than No. 6, the dimensions of the junction-cabinet must be obtained from the Inspection Bureau.

8. Where the service cables installed by the Company are terminated in a junction-cabinet enclosing the service cables, the customer's service conduit should be terminated at the junction-cabinet and locked into it. A sufficient length of wire must be left to permit the Company to make the connection to the service cables, inside the junction-cabinet.

9. The service-switch cabinet must be of ample size to permit the safe handling of the service cables, and the switch-panel arranged in such a manner as to permit the removal of the service cables for repairs or replacement without removing the panel. The service-switch must be fitted with lugs for connection to the service cables.

10. Where the size of the installation requires more than one set of underground cables into the customer's premises, the customer must install, at his own expense, a fuse-extension service-switch on each set of cables. A name-plate holder must also be mounted on the panel at each service switch, in order to facilitate ready identification, in case of an emergency on any of the several services.

ENCLOSED TRANSFORMER INSTALLATIONS.

I. GENERAL.

1. These specifications refer to transformer installations made on customers' premises where such installations require enclosures. These enclosures are subject to variation in detail, as local conditions may make necessary. Sketches showing the requirements of the Company will be furnished for each installation.

2. The enclosure for each installation must be constructed in accordance with the rules of the Electrical Code of the Department of Gas and Electricity and of the Building Code of the Department of Buildings of the City of Chicago.

3. The enclosure complete with all necessary facilities must be furnished by and at the expense of the customer, and constructed in accordance with these rules and the sketches furnished by the Company.

4. The enclosures must preferably be located on the first floor of the building, adjacent to an outside wall, accessible to a driveway, and provided with an outside entrance. If the enclosure cannot be so located, a free passageway must be provided from the enclosed space to the outside of the building to facilitate the installation and removal of all equipment. The space must be free from pipes or other obstructions.

5. The enclosures must be accessible at all times to properly authorized employes of the Company and to them only.

6. The necessary conduits from the enclosures to the service point selected by the Company at the property line must be provided by and at the expense of the customer and installed under the supervision of the Company.

7. The Company will, at its own expense, install and connect within the enclosure, the necessary service equipment, such as transformers, oil switches, and auxiliary apparatus.

8. One set of cable connections and service equipment will be provided by the Company for any customer, except that at the customer's request, the Company will install additional points of supply and cables connecting thereto, provided, that the customer shall reimburse the Company for the extra cost of making more than one installation. The service equipment at all points of supply in such cases shall be the property of the Company.

9. All conduit and cable on the customer's premises, used solely for additional points of supply, shall be installed at the expense of the customer and shall be his property.

10. The Company reserves the right to use these transformer installations to serve customers on other premises. In such cases, a reasonable rental, agreed to by the electrical engineer of the Company, will be paid by the Company for the proportionate part of space occupied by equipment used to supply such other customers.

11. In the following rules, the enclosures will be referred to in connection with 4,000-volt installations as "TRANSFORMER VAULTS," and in connection with installations above 4,000 volts as "INDUSTRIAL SUBSTATIONS."

II. TRANSFORMER VAULTS.

Location.

1. If the vault cannot be located on the first floor, space on another floor will be accepted if provided with the proper facilities. Where so located, a permanent overhead supporting structure, capable of handling a load of approximately 6,000 pounds must be provided by the customer, for raising and lowering the transformers in a vertical position from the delivery level to the desired level. Unless access to this space is had from a floor at the same level, an approved platform at the door level must be provided.

Walls and Ceiling.

1. The enclosing walls must be constructed of concrete, not less than 6 inches in thickness, or of brick not less than 9 inches in thickness.

2. The ceiling must be waterproof and constructed of fire resisting materials, such as concrete, hollow tile, or equivalent.

Floor.

1. The floor must be constructed of concrete of sufficient thickness to carry the weight of the transformers and the weight of electrical equipment to be installed, both of which will be indicated on the sketches provided by the Company. The floor must be laid with a pitch of ¼-inch per foot from the side walls to the drain.

Entrance.

1. A vault must be provided with an outside entrance for the installation and removal of equipment and an inside entrance for the use of the Company's men for operating and inspecting purposes. The entrance provided for handling equipment must have a clear headroom of at least 7 feet above the threshold and a minimum clear width of 4 feet, 6 inches.

2. A concrete threshold 6 inches high must be installed in all doorways. All doorways must be thoroughly closed by means of an approved tight-fitting, fireproof door.

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The door must be so hung as to swing outward from the entrance, and must be provided with a hasp suitable for a standard padlock, which latter will be provided by the Company.

3. Surface entrances to basement or sidewalk vaults must be equipped with transformer manhole frames and covers, or hinged steel doors approved by the Company.

4. All passageways between the entrance and the vault must have the same clear headroom and width as specified for the entrance.

Headroom.

1. Clear unobstructed headroom of not less than 9 feet must be provided in the vault.

Drainage.

1. The floor of the vault must be provided with an adequate system of floor drainage to take care of a possible overflow of oil or water.

Ventilation.

1. Sufficient ventilation must be provided to maintain the transformers within their safe operating temperature range. All ventilating openings into the building not connected to chimneys or flues must be provided with automatic or manually-controlled dampers to prevent the emission of smoke or fire. The arrangement and size of ventilating openings will be shown on sketches provided by the Company.

2. If natural ventilation is inadequate, forced ventilation must be provided. Plans for forced ventilating equipment and methods of installation and control must be submitted to the Company for approval. Ventilating equipment must be of sufficient capacity to completely change the air every two minutes.

Floor Space.

1. The vault must have a floor space in proportion to the transformer capacity to be installed, the exact size in each case to be specified by the Company. A customer's drawings of the vault must be submitted in duplicate to the Company for approval.

2. The room must be rectangular in shape, not less than 11 feet in width and from 26 to 37 feet in length, depending upon the number of transformers to be installed.

Vault Equipment.

1. All electrical equipment required for switching, transforming, and protective purposes, including primary and secondary bus work in the vault, will be installed, maintained and operated by, and at the expense of, the Company.

2. The customer must extend all secondary service cables to points designated by the Company, inside the vault. Such cables must be of sufficient length to be connected to the secondary busses, and be equipped with necessary lugs ready for connection. The final connection of the service cables to the busses will be made by the Company.

Primary Cable.

1. The primary cable required on the customer's premises to connect the vault equipment to the Company's system will be installed by the Company at the expense of the customer.

Meter Wiring and Service Switch.

1. The customer must provide a suitable panel or space on the switchboard outside of the vault for the installation of the Company's meters; and provide thereon the wiring, test links, and terminals required for such meters. The customer's secondary service switch must be placed outside the vault.

Lighting.

1. The necessary conduit and outlet boxes for the vault lighting system must be installed by the customer as a part of the vault structure. The location of lighting outlets will be shown on sketches furnished by the Company.

III. INDUSTRIAL SUBSTATIONS.

General.

1. The installation is to be placed in two adjacent fireproof rooms provided by the customer and must follow the specifications herein set forth and such supplemental specifications as the Company, may, in special cases, provide. One of these rooms containing the line and transformer primary switches, bus bars, and all 12-000-volt equipment will be known as the "Switch Room." The other containing the transformers and auxiliary control and protective equipment will be known as the "Transformer Room."

2. These rooms must at all times be readily accessible for inspection and repairs and where located above the ground floor a permanent overhead supporting structure, capable of handling a load of approximately 24,000 pounds, must be provided for hoisting the transformers to the required level. Unless access to such rooms is had from a floor at the same level, an approval platform at the room level must be provided, together with a stairway to reach same from the floor below or from the ground, so arranged as to give convenient access to the rooms at all times.

Meter Panel.

1. The customer must provide a suitable panel or space on a switchboard outside of the Switch and Transformer Rooms for the installation of the Company's meters and must also provide thereon the wiring, test links, and terminals required for such meters.

Ownership.

1. All building work in connection with the Switch and Transformer Rooms, including the concrete switch and bus structure in the Switch Room, and the necessary conduit in walls and floors, must be installed by and at the expense of the customer and shall remain his property. Detail plans for the Switch and Transformer Rooms, including the concrete structure, will be furnished by the Company.

2. All electrical equipment required for switching, transforming, and protective purposes, including primary and secondary bus work, in the Switch Room and Transformer Room, will be installed, maintained, and operated by and at the expense of the Company, with the exception that where the physical location of a customer's service entrance is not adjacent to the Company's secondary busses, the customer will reimburse the Company for the additional expense necessary to reach this remote location, and further, that the customer will extend his lighting service cable to the metering current transformers at the lighting transformer, ready for the Company to connect to its secondaries.

3. In case of a loop service, the Company will furnish, install, and maintain at its expense all 12,000-volt cable.

Lighting.

1. Approximately 8 lighting outlets are required in each of these rooms. Lighting service is to be 115 volts A.C.

SWITCH ROOM

Structure.

1. The Switch Room must have a minimum floor area of approximately 325 square feet (preferable 13 x 25 feet) with a minimum head room of 12 feet. Standard fireproof doors must be provided to give access to, and emergency exits from, this room. In addition to the standard latches provided for these doors, they must also be equipped with bolts or locks. Where locks are required, standard cylinder locks will be furnished to the customer by the Company. All doorways must have a 6-inch threshold. Openings suitably located and equipped with adjustable louvres must be provided for the ventilation of this room.

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Equipment in the Switch Room.

1. The electrical equipment in the Switch Room will consist of high-tension switches, disconnects, and other necessary auxiliaries to protect the customer's service.

TRANSFORMER ROOM

Structure.

1. The Transformer Room must have a floor space in proportion to the transformer capacity to be installed, (the exact size in each case to be specified by the Company,) and the headroom must be at least 12 feet. An exterior fireproof door must be provided in this room, approximately 6 feet wide by 10 feet or more high, which will give ready access for the installation of the electrical apparatus. This doorway must have a 6-inch threshold and the door must be equipped with latches and bolts in addition to the standard cylinder lock furnished by the Company.

2. The floor of the Transformer Room must be provided with an adequate system of floor drainage to take care of a possible overflow of oil or water.

Equipment in the Transformer Room.

1. The electrical equipment in the Transformer Room will consist of the necessary power and lighting transformers, relay and control equipment, and high-voltage connections between the Switch Room terminals and the primary terminals of the transformers; also on the secondary side of the transformers all necessary copper bus and supporting framework between the secondary terminals of the transformers and the metering current transformers, which will be located as near as possible to the main transformer terminals.

Ventilation.

1. The customer must provide for air supply and exhaust in sufficient amount to insure proper cooling of the transformers. Where the temperature of the surrounding air is sufficiently low, properly located louvres of adequate size in the side walls, in addition to roof ventilators or their equivalent in exhaust duct to outside air, may be sufficient. Where the location renders this method of cooling inadequate, forced ventilation must be provided by the customer and should be so arranged that the supply will be adequate at all times. The Company will inform the Customer regarding the details of the ventilating provisions in each case. The system of ventilation must provide for a complete change of air in the Transformer Room every two minutes, assuring proper cooling of the maximum transformer capacity, which may be installed in the particular Transformer Room. Plans for forced ventilating equipment and methods of installation and control must be submitted to the Company for approval. If adequate ventilation is not available, or if the customer's load conditions require the installation of water-cooled transformers, the customer must provide suitable water supply and waste connections for this method of cooling, the details for which will be furnished by the Company.

WIRING.

Meter Connections.

1. Wiring must be so arranged that a separate meter may be installed for each class of service supplied under the Company's schedule of rates, as follows:

I Rate A.

1. Available for any customer using the Company's standard service for lighting purposes or for both lighting and power purposes, provided that electricity will not be furnished hereunder for welding machines, wireless telegraph apparatus, or other power apparatus in which the use of electricity is intermittent or subject to violent fluctuation and the operation of which may interfere with lighting service.

2. Where the rated capacity of the customer's installation is 1½ K. W. or less, the maximum demand is determined in accordance with a table set forth in the rate schedule, which provides for different values of demand for commercial and for residence lighting. The arrangement of meter connections of such installations must be in accordance with the following regulations:

(a) The wiring of residence and commercial installations must be arranged for separate watt-hour meters.

(b) The lighting of halls, entrances, and basements of apartment buildings will be considered as commercial lighting provided that where the hall, entrance, and basement lighting installation has a rated capacity of 200 watts or less and where the owner occupies one of the apartments in the building as his place of residence, this lighting load may be connected to the meter for his apartment, and, if so connected, such an installation will be considered as residence lighting during the period of such occupancy.

(c) Where apartments and stores or shops are in the same building the apartment lighting will be considered as residence lighting and the store or shop lighting will be considered as commercial lighting, and the wiring should accordingly be arranged for separate meters, provided, however, that if the customer desires, both installations may be combined on one meter, and the combined installation will be considered as commercial lighting. (For combined installations exceeding 1½ K. W. see 3-(b) below.)

(d) Where a portion of a store or shop is used as living quarters, and the wiring is arranged for a single meter for both the store or shop and the living quarters, the installation will be considered as commercial lighting.

3. (a) Where the rated capacity of a customer's installation is more than 1½ K. W., the wiring must be arranged for the installation of demand meters.

(b) In case the residence and commercial lighting installations of a customer have an aggregate rated capacity of over 1½ K. W. and are in the same building, both installations should be arranged for connection to one watt-hour meter, with demand-meters.

II Rate B.

1. Power service is supplied under this rate, and is defined as "electric service used for other purposes than lighting." Service for photographic printing, bath cabinets, and other kinds of equipment which are not used for general illumination, will be considered as power service and may be served under Rate B, if desired.

2. In the case of direct current installations, having rated capacity of more than 1½ K. W., the maximum demand is measured, and provisions must be made for setting a demand-meter.

3 In the case of alternating current installations having a rated capacity of 10 H. P. or more, provisions must likewise be made for setting a demand-meter.

III Rate C.

1. The lighting and power service for large users may be combined under Rate C. However, on the alternating current system a separate service and meter may, at the option of the Company, be provided for the lighting service, and in such cases the wiring must be arranged accordingly for meters.

Residence and Apartment Loads.

1. Every residence and apartment lighting installation which does not exceed 3,000 watts, or 48 sockets must have a 2-wire service main and 2-wire meter loops, as such an installation will be connected to the Company's system by two service wires at 115 volts. Where the installation exceeds 3,000 watts, or 48 sockets, it must be wired for 3-wire service and a 3-wire meter. All wall receptacles other than brackets will be figured at not less than 100 watts each.

TO COMBINE in the Electrical Installation the practical judgment of years of experience with a sympathetic and intelligent understanding of its purpose in the modern structure is a function this Company has discharged with credit and enduring satisfaction.

Belden Hotel,
Chicago

Fridstein & Co.,
Engineers

DEARBORN ELECTRICAL CONSTRUCTION CO.

500 North Dearborn Street, Chicago

Commercial Loads.

1. Every business lighting intallation of over 1500 watts must have a 3-wire service main and 3-wire meter loops except where the installation consists of 1-2000 watt circuit only. This must obviously be connected 2-wire. If the installation is 1500 watts or less, it must be wired with a 2-wire service main and 2-wire meter loops. Motors operating on 115 volts and heating appliances on the lighting service will not be considered in determining 2-wire and 3-wire installations where the rated capacity of such equipment does not exceed 25% of the lighting load.

Business and Residence Loads in Same Building.

1. On installations where there are stores and apartments in the same building, the rule governing the service and meter installation is as follows:

Where the total connected wattage is 3000 watts or less, add to the total connected wattage of the stores ¼ of the connected wattage of the apartments, and, if the total is 1500 watts or less, the service mains and meter loops must be 2-wire. If this wattage, however, is in excess of 1500 watts, service mains must be 3-wire but the meter loops will be governed according to the rules above on residence and commercial lighting. Where the total connected load is in excess of 3000 watts, the service must be 3-wire.

Motor Loads.

1. In direct current territory where the aggregate power load does not exceed 10 H. P., the motor should usually be wired to connect to the lighting meter.

2. In alternating current territory, the fluctuation in voltage caused by the starting currents prevents the connecting of motors larger than ½ H. P. of the split-phase type, or larger than 1 H. P. of the repulsion-induction type, to the lighting service, except is special cases. Two or more motors, not larger than the above mentioned sizes, may be connected to the lighting service where the aggregate does not exceed 2 H. P.

Miscellaneous Loads.

1. Single D. C. stereopticons, outlets for battery charging, and other devices which are operated most economically at 115 volts will be approved for this voltage. Where there is an installation of more than one such device in the same premises, they must, if the total wattage of the installation exceeds 1500, be connected to a 3-wire main and be balanced as nearly as possible.

2. Every alternating current vehicle-charging mercury arc rectifier in a private garage must be connected to the customer's lighting service, provided such a service is already installed. If the existing lighting service is a 2-wire service, a 3-wire outlet must be provided.

3. If, at the time the rectifier is installed, there be no existing lighting installation in the premises, and later the customer desires to put in a lighting installation, such an installation must be wired for a 3-wire service.

4. All rectifiers requiring an input of more than 2 K. W. must be operated at 230 volts.

5. In theaters, all alternating current or single phase motors, and such motion picture and spot arcs as are not supplied through 3 phase converting apparatus, must be connected to the same meter.

6. Alternating current arcs requiring more than 2 K. W. must be operated at 230 volts.

7. Where transformers are used in connection with motion pictures arcs or spot arcs they must be operated at 230 volts.

8. In the case of welding machines, X-ray machines, hoists, elevator motors, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence or fluctuation, where in the Company's judgment, such apparatus is necessary to prevent undue interference with the Company's service.

Auto Transformers.

1. Where the lighting is connected to the power service by the use of an auto-transformer, as under Rate "C," such transformer must be provided at the expense of the customer. The auto-transformer must be connected between the two mains having the least difference of potential to the earth. Where the load is 20 K. W. or less, the capacity if the auto-transformer should be not less than 25% of the connected load in watts.

Voltage Regulation.

1. The wiring installed in the customer's premises should be of such capacity that the entire connected load can be carried with a loss in voltage of not more than 2% between the service entrance and the most remote lamp on the premises.

Switchboards.

1. Specifications and blue prints for service and meter-switchboard installations must be submitted to the Distribution Division of the Company for approval before construction of the switchboard is begun.

2. Fuses must be so arranged that they will be readily accessible for the purpose of replacement, and to this end, it is recommended that no more than three rows of switches be placed on a switchboard.

3. To prevent overheating of switches, fuses, and cables, it is recommended that all the lugs have a conductivity of not less than 60% of that pure copper and that their cross-sectional area be such that they will not be required to carry continuously more than 600 amperes per square inch. They should have a bolting contact surface of not less than 1 square inch for each 150 amperes of current.

4. The general arrangement of the connections on the back of the board must be such as to render it possible to make repairs or alterations with a reasonable degree of facility and safety while the board is in service.

5. The bus bars must be rigidly supported and the arrangement of the feeder cables between the terminal of the conduit system and the back of the switchboard must be made in a systematic and orderly manner and the cables must be segregated as far as possible, with a view to minimizing the possibility of serious interruption to the service.

6. Where the Company's service cables are extended inside of the customer's premises to the switchboard and where such cables are not protected by duct or conduit they must be properly roped and cemented at the expense of the customer.

Cutouts.

1. Fuse-blocks and service-switches must be equipped with fuses of approved type and capacity at the time of their installation.

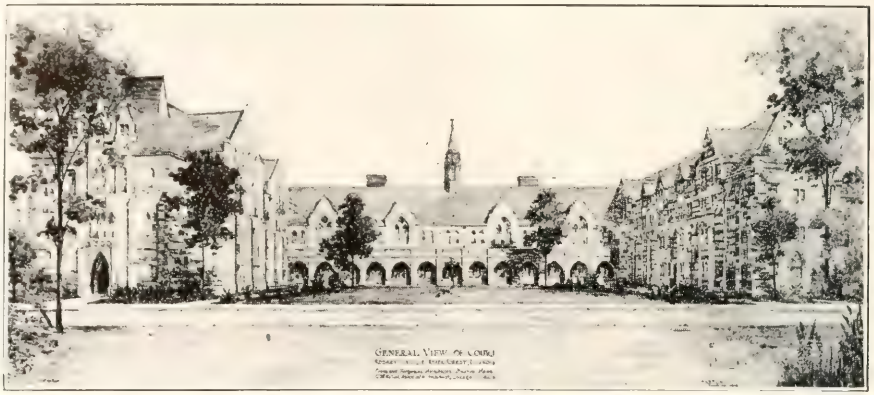
2. The neutral wire of a 3-wire service-switch or cutout block for branch mains, except for 3-phase, must not be fused.

3. The neutral wire must be connected to the center blade of all 3-pole switches except for 3-phase. On 3-phase installations the two phases having the least difference of potential to earth must be connected to the two outer blades of the service-switch.

4. Switches and fuse blocks must not be installed above or in close proximity to laundry tubs, sinks, or other plumbing fixtures.

Grounding Conduit on Neutral Service Wire.

1. The use of the neutral service wire for grounding conduit is not permitted. The conduit should preferably be grounded to



Rosary College, River Forest, Ill. Cram & Ferguson, Charles W. Kallal, Asso. Architects

J. F. FISHER, Pres. E. G. FISHER, Treas.

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565 W. Washington Street

CHICAGO

the cold water piping system, in accordance with the rules of the Department of Gas & Electricity of Chicago.

2. The customer must ground the neutral wire of his installation separately from the ground provided for the conduit system. This neutral ground must be installed according to the rules of the Department of Gas and Electricity of the City of Chicago. 3-phase and 2-wire, 230 volt single phase systems having no wires within the building at ground potential, are not to be grounded at the building service.

APPARATUS.

Welders and Furnaces.

Call Commonwealth Edison Co., Randolph 1280 for information.

X-Ray Machines.

Call Commonwealth Edison Co., Randolph 1280 for information.

Electric Ranges, Ovens, and Heating Appliances.

1. Electric ranges and other heating appliances in which the aggregate rating of the heating units is not more than 2 K.W., will be connected for 115 volt, 2-wire service. Where the aggregate rating of the heating units exceeds 2 K.W., they must be so arranged that they may be connected to a 3-wire, 115-230 volt circuit, and the units must be balanced as nearly as possible on each side of the circuit.

2. Electric ranges and heating appliances for family use must be connected to the lighting service, if one is installed.

3. Electric ranges, ovens, and heating appliances of 10 K.W. and less, installed in places of business, must be connected to the lighting service, if the customer has a lighting service only. If, however, there is both, a lighting and a single-phase power service, or a single-phase power service only, such apparatus should be connected to the power service. Where the K.W. rating is in excess of 10 K.W., or where the heating load is intermittent, inquiry should be made of the Distribution Division of the Company, as to how the particular installation should be connected.

Nameplates.

1. All electrical equipment such as motors, welders, furnaces, X-Ray and radio apparatus, heating utensils, and the like, must be provided with nameplates showing the rating of the apparatus. This rating must be in kilowatts, horsepower, kilo-volt amperes, or amperes and volts, cycles, phase; according to the nature of the apparatus. The character of current required for the operation of such apparatus must also be designated.

MOTORS.

General.

1. The following motor regulations are necessary for the purpose of securing uniform service for all customers, as the successful operation of motors on the same circuits with lighting apparatus requires that the normal voltage of the supply circuit be closely maintained.

2. In the case of hoist or elevator motors, welding machines, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence or fluctuation, where in the Company's judgment, such wiring or equipment is necessary to prevent undue interference with the Company's service.

3. Stationary vacuum-cleaner motors of over 1 H.P. which are used in apartment buildings, must be so wired that separate meters for them can be installed. This rule rule prohibits the connection of these motors to the individual tenants' meters.

Direct Current.

1. Direct current motors of 1½ H.P. and smaller may be operated on either 115 or 230 volts. Motors larger than 1½ H.P. must be operated on 230 volts.

2. A starting resistance is recommended in connection with all direct current motors, but motors not larger than ½ H.P. of the shunt type, ¾ H.P. compound, and 2 H.P. series wound, not requiring a starting current in excess of the values given in the starting current tables, may be installed without starting resistance.

3. Direct current motors aggregating 10 H.P. or less must usually be wired so that they may be connected to the lighting meter.

Alternating Current.

1. All alternating current motors which start frequently, such as those operating coffee mills, meat grinders, shoe repairing machines, electric pianos, pumps, carbonators, etc., must be wound for and connected so as to operate on the Company's 230 volt service, except that the repulsion induction type of motor, of less than ¾ H.P., may be operated on 115 volt service.

2. Split-phase motors of ¼ H.P. and smaller, which do not start frequently and any repulsion-induction motor of ½ H.P. and smaller, may be operated on 115 volts when the starting current does not exceed 15 amperes, provided the lighting service is not interfered with by the operation of the motor.

3. The wiring must be so arranged that all motors of the repulsion-induction type of 1 H.P. and less, or of the split-phase type of ½ H.P. and less, may be connected to the lighting service and meter. Either type of motor above these sizes must be wired for separate service and meter. When the aggregate rating of two or more motors of the types mentioned does not exceed 2 H.P., they must be wired to the lighting service. This will require 3-wire service and 3-wire meter loops, where 230 volt motors are installed. Where larger motors are installed, or where the aggregate is more than 2 H.P., the wiring must be so arranged that all motors can be connected to a separate service and meter.

4. Special permission may, in some cases, be obtained from the Distribution Division of the Company to connect the lighting service, motors larger than 1 H.P. of the repulsion-induction type, or ¾ H. P. or larger of the split-phase type, where these motors operate stationary vacuum-cleaners and house-pumps. The granting of this special permission will depend on the size of the building, the capacity of the Company's lines, and the building mains.

I. Single Phase System.

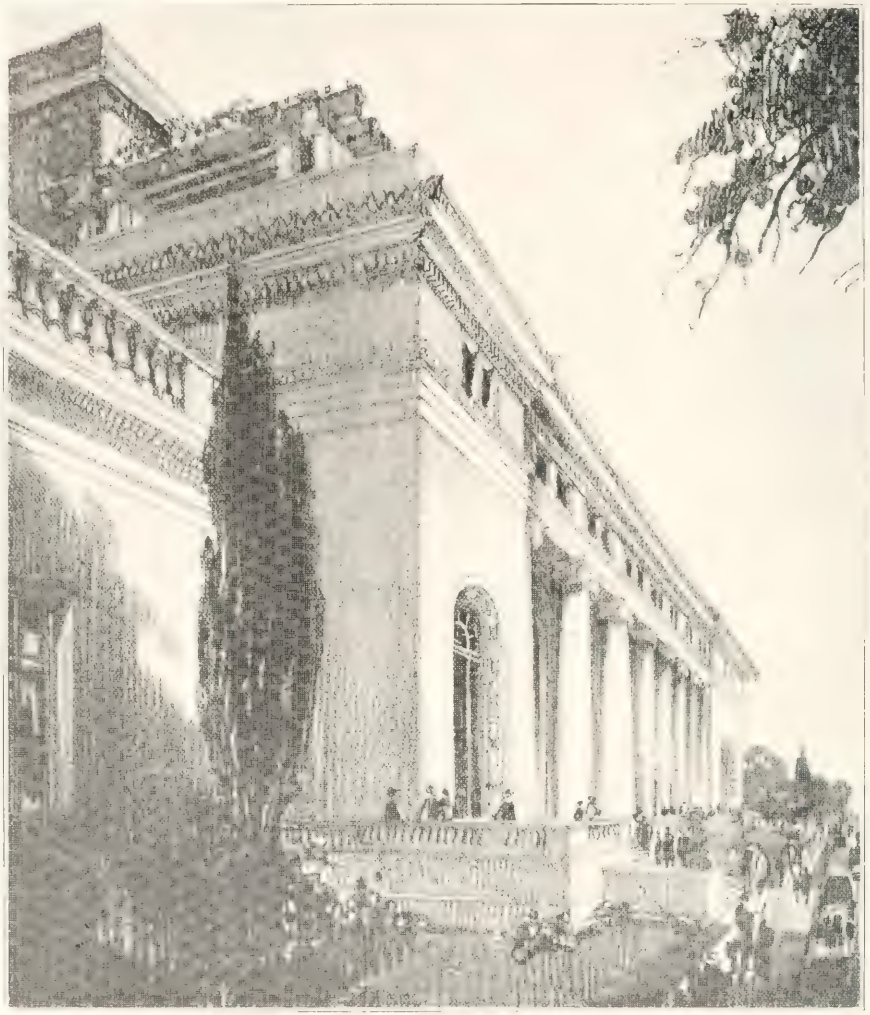
1. When single phase motors or other apparatus are connected to one phase of a 3-phase installation, they must be connected between the two wires having the least difference of potential to the earth. The Distribution Division of the Company must be notified when any single phase motor is to be connected on a 3-phase installation.

2. No motors larger than 5 H.P. will be supplied on the single phase system except by special permission given in each case by the Distribution Division of the Company.

II. Three-Phase System.

1. Motors of 5 H.P. or more are supplied from the 3-phase system in a large part of the alternating current territory, but inquiry should be made of the Contract Department of the Company as to the proximity of 3-phase lines to any particular location at which such power may be desired.

2. 3-phase service will not be provided for installations aggregating less than 5 H.P. unless the customer deposits with the Com-



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ROBT. J. SAMPLE, President — Established 1898

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pany a sum equivalent to the excess cost to the Company of installing a 3-phase service and meter, above the cost of installing a 3-phase service and meter, plus the excess cost of installing a 3-phase line extension over a single phase extension, provided such an extension is required. In case the customer's power installation shall subsequently be increased to a total rated capacity of 5 H.P. or more, the Company will return the amount of the deposit, provided the additional motors installed are 3-phase.

3. Reverse-phase relays or series-wired hatch-limit switches must be installed on all 3-phase elevator, crane, and similar installations, as required by the Department of Gas and Electricity of Chicago.

III. Large Sizes.

1. Motors having a rated capacity of 50 H.P. and larger, must be, whenever practicable, of the synchronous type, provided that this requirement will be waived if the power factor of the total installation will be at least 85% at normal full load. If synchronous motors are impracticable, motors having a rated capacity of 50 H. P. and larger, must be of the wound-rotor or slip-ring type.

2. Motors having a rated capacity of 100 H.P. or larger, must be of the synchronous type, provided this requirement will be waived if the power factor of the total power installation will be at least 85% at normal full load.

IV Starting Apparatus.

1. All motors of 7½ H.P. rating, and above, must be equipped with starting apparatus.

2. Every starting device must be equipped with a no-voltage release which will cause it to be thrown to the starting position, or the circuit opened entirely, in case of an interruption to the power supply. Motors which are equipped with an internal resistance, making it unnecessary to install a compensator in order to reduce the starting current, must be equipped with a no-voltage release device unless the internal resistance is automatically cut in by the reduction of the motor speed when the power circuit is opened. For motors of large capacity which are difficult to start, the no-voltage release must have a time element relay, which will prevent the opening of the circuit in the event of momentary voltage fluctuation.

3. In the case of the star-delta starting method, the starting-switch must be so arranged that it cannot be thrown into the running position before being thrown into the starting position. Motors started by this method must be equipped with a no-voltage release device.

4. Special permission will be given for the connection of special high-resistance-rotor elevator motors not larger than 10 H.P. without the use of a starting device, provided, the starting current does not exceed the values given in the table for starting currents.

Starting Current.

1. As voltage regulation is affected by the amount of current taken from the line, a motor exceeding the maximum allowable starting current will not be connected to the lines of this Company, since its operation would prevent satisfactory service to other customers using the lighting service of the Company. The instantaneous current (determined by test or based on the value guaranteed by the manufacturers) drawn from the lines by any motor (with the starting device, if any required, in the starting position) must not exceed the value for the rated horsepower of such motor, as obtained from the following tables:

2. Single Phase—60 Cycle.

Horsepower	Volts	Starting amperes
½ H.P. and below	220	15
¾ H.P. and 1 H.P.	220	20
		Starting amperes per horsepower
1¼ H.P. up to and including 5 H.P.	220	15
6 H.P. and above	220	11

Three-Phase—60-Cycle.

Horsepower		Starting amperes per phase per horsepower
5 H.P. and below	220	13
6 H.P. up to and including 30 P.H.	220	9
31 H.P. and above	220	6

Current values in the above tables are those indicated by a suitable well-damped ammeter in the motor circuit on the line side of the compensator, and are 75% of the permissible locked-rotor values.

3. Direct Current.

Horsepower	Volts	Starting amperes per horsepower
3 H.P. and below	220	12
Above 3 H.P.	220	9

Current values in the above tables are those indicated by a suitable well damped ammeter on the line side of the starting resistance.

Fire Pumps.

1. Fire-pump motor installations must be made in accordance with the rules of the authorities having jurisdiction over such installations.

2. Meters for fire-pump installations shall be of the shunt type for direct current system and of the current transformer type for alternating current systems. A meter-cabinet of shape and dimensions as shown on the drawings on pages 60 and 61, must be furnished and installed by the electrical contractor. This cabinet must be provided with a door which can be fastened with a padlock, which will be furnished by the Company. The cabinet may be located at any point in the service run, provided it is readily accessible and not subject to moisture or vibration. Conduits carrying service mains must enter the cabinet in a standard manner, and the cables must be long enough to connect with lugs on the shunts or current-transformers. The lugs for the shunts or current-transformers will be furnished by the Company, but are to be installed by the customer at his expense. A 1 in. slate base for the mounting of the meter and other equipment, standard cartridge-fuse cutout-block of capacity shown, must be furnished and installed by the customer at his expense.

3. Where a separate service is required for a fire pump, the customer must pay the cost of the service installation. Where a meter has been furnished by the Company for regular power load, the usual rental will be charged for the separate fire-pump meter, as provided under "Meters," sub-title "General," paragraph 2, page 43. In case a printing meter is required the usual rental will be charged and the customer must pay for installation of such meter.

METERS.

General.

1. The Company will install one meter or one unified set of meters for one class of service.

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Martin C. Schwab,
Consulting Engineer

2. A monthly rental charge for each additional watt hour or demand meter is made by the Company when, at the request of the customer, and for his convenience, there is an installation of more than one meter on his premises for one class of service. This rental is based on the size of the meter installed.

3. The Company must be consulted whenever it is necessary to know in advance the type and size of meter which a given installation will require. Information relative to the type of watthour meters and maximum demand meters to be used on large installations must be obtained from the Distribution Division of the Company before wiring is completed.

Location.

1. All meters must be installed in a suitable place as near as practicable to the point at which the service enters the building. The wires should be enclosed in a continuous metal conduit, containing no junction or outlet-boxes between the service entrance and the meter. The installation of load-wires in the same conduit is not allowable. In office buildings, special meter-closets of ample size must be provided on each floor; in apartment buildings, all meters should preferably be installed in the basement, and the circuit to each apartment should be carefully labeled. In residences, meters should be installed in the basement, or in a rear hall, and not in the attic.

2. The requirements of a "suitable place" for a meter are the following:

(a) Meters must be accessible to the Company's employes at all reasonable times, and must be so located that they may be easily read, inspected, and tested, with a minimum of annoyance to the tenants. Small capacity meters must be so installed that the top of the meter fitting is not more than six feet from the floor, and on meters of a capacity of 100 amperes and above, this distance must be not more than 4 feet 6 inches. Meters must not be placed in bedrooms, closets, bath or toilet rooms, or in any room commonly kept locked, in too close proximity to coal bins, in elevator or ventilator shafts, near stoves, radiators, sinks, wash tubs, steam piping, heaters, or boilers. Meters must be at least 3 feet from any gas meters or gas piping unless a suitable barrier is provided. Where meters are to be installed in a narrow passageway or in a narrow space such as back tanks, switch-boards or machines, the spacing in front of the meter board must be as follows: For 30 and 60 ampere meter-fittings, 3 feet and for 100 ampere fittings and above, greater space, the amount to be determined by the Inspection Bureau of the Company, depending on the character of the installation. Meters placed behind boilers or heating tanks which are not insulated to prevent radiation of heat, or behind machines in motion, must be more than 3 feet from such equipment, and in such cases the amount of space is to be determined by consultation with the Inspection Bureau of the Company.

(b) The location selected must be free from moisture. A watthour meter must never be placed under a water pipe from which water may drip, as a result of condensation. When a damp location is unavoidable, a moisture proof cabinet must be provided by the customer to contain the meter.

(c) The location must be free from vibration. Where traffic is heavy, or cars are passing, meters should be placed upon a wall at the building-line, rather than upon the front curb wall, and must never be placed under the sidewalk, except by special permission from the Distribution Division of the Company. They must not be placed on any insecure partition, over a doorway, or in a stairway.

(d) Meters must be located, if possible, so that they will not be exposed to mechanical injury. If this is unavoidable, a suitable cabinet must be provided by the customer to contain the meter, so as to protect it thoroughly from possible damage.

(e) The meter location must be as free as possible from magnetic disturbance. Meters must not be installed in close proximity to motors or generators or cables carrying heavy loads. Cabinets for direct current meters must be of asbestos board or non-magnetic metal.

3. When meters are to be installed for construction work, substantial cabinets of weather-proof construction must be provided by the customer to protect them from injury. The final connections between the customer's wiring and the Company's mains will, in every instance, be made by the Company. When it is possible, a meter location which can be used throughout the construction period should be selected at the outset.

4. Meter-cabinets must be of ample size to permit the safe handling of wires for connecting, disconnecting, or testing the meters. If a metal cabinet is used, the inside must be lined with suitable insulating material.

5. Meter-fittings for private garages must be so located that the meter can be read without the necessity of entering the garage except in cases where the garage is open or where a key can be obtained on the premises at all reasonable hours. A meter can be read witout entering the garage if installed so that it faces a window made in the wall of the garage. This window must be covered by glass so as to render the meter visible and in addition, protect it from damage and theft. When this method is used, the meter board must be hinged or otherwise installed so that the meter will be accessible for testing. Subject to the approval of the Company, other methods of installing the meter so that it may be read without entering the garage will be considered.

Meter Loops.

1. Meter loop fittings must be provided on all installation where the meter installed is of smaller capacity than 200 amperes. The size of a meter is determined by the amount of current required on any given installation and not by the connected load. Therefore, it is necessary to take this fact into consideration when determining whether or not a meter fitting is necessary.

2. When meter loops are provided for meters of smaller capacity than 200 amperes an approved meter safety cabinet and meter connection-block must be installed. Approved safety cabinets are of a type which permit the mounting the Company's watt hour meter in combination with the cabinet so that by means of suitable adapters or end walls, all connecting wires are completely enclosed. Approved connection-blocks are of a type which permits disconnecting the meter for exchange or test without interruption to the customer's service. All necessary adapters or shutters will be furnished by the Company and installed with the watt hour meter.

3. Safety-cabinets and meter connection-blocks, which can be used interchangeably to a large extent, have been standardized and they are now obtainable from a number of different manufactures. They comprise in the 30-ampere size.

(a) A combination fused service-switch and connection-block for single installations.

(b) A fused connection-block and cabinet for bank or single installation with separate service-switch.

Connection-blocks for installations of over 30 amperes are, as a rule, not available in combination with fuse blocks or service-switches.

Sixteenth Church of Christ, Scientists, Chicago — Howard L. Cheney, Architect

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5. For the mutual protection of customer and Company, all service and meter-cabinets will be kept sealed in order to accomplish the full safety features of the equipment. Consequently, when they are of a fused type, circuit fuses must also be provided on the load side of the meter which will be accessible to the customer. The fuses in the meter cabinet should be of a size determined by the capacity of the connection-block and should in all cases be heavier than the customer's fuses.

6. A card-holder must be provided on every meter loop fitting. The contractor must insert in this holder a card showing the complete address and the location in the building of the premises connected to the meter fitting.

7. Meter-loops or meter-fittings must be so arranged that the meters can be placed at least 6 inches away from iron cabinets and cut-out boxes, conduits, ceilings or walls, so as to permit the safe handling of wires during tests. On installations requiring 200 amperes, meters or larger this clearance must be 12 inches.

7a. The minimum distance between a floor and the bottom of the lowest meter-fitting must not be less than 2 feet.

7b. On alternating current installations there must be 14 inches clearance, and on direct current installations 28 inches clearance, from the top of a meter-fitting to the bottom of the next one above or to the bottom of a cutout cabinet or any grounded surface. This distance must also be maintained between the top of a meter-fitting and a ceiling.

8. The distance between centers of meters of 50 amperes or less must not be less than 10 inches for A. C. and 15 inches for D. C. meters. Meters of a capacity in excess of 50 amperes must have a distance between centers of not less than 24 inches, and the leads of one meter must not run within 12 inches of another meter.

9. Service and house leads for type C. S. 2 and type C. S. 3 Thompson direct current meters, which are the types usually installed in size of 200 amperes and larger, must be carried in a metal trough to a point directly beneath the meter, and must be brought outside the trough through bushings spaced far enough apart so that the loops may be run in a direct vertical line to the meter terminals. They must be so anchored that the weight of the cables will not rest on the meter terminals. The length of the meter loop required outside the trough is determined by the type of meters to be installed.

10. When external resistances, current or potential transformers are used in connection with meters, they must be located where they are accessible for inspection and can be removed without danger of making a short circuit.

11. Contact-making clocks for operating type P demand meters must not be installed within a loop formed by the cable leads nor close to conductors carrying heavy currents, as the magnetic field may affect their accuracy, nor should they be installed in any place subject to extreme changes in temperatures.

Meter Fuse Protection.

1. All meters must be protected by suitable fuses of approved capacity. Meters must never be placed between the service and the service-switch.

Meter Board.

1. On installations where meter fittings are installed of less than 200 amperes capacity, a suitable meter-board of pine or other soft wood, not less than ⅞ in. in thickness, or transite board (or equivalent), not less than ½ in. in thickness, must be provided by the customer and fastened rigidly to the wall or other support. If transite board or equivalent is used it must be so mounted that it fill be accessible from th back of the board in order to permit a nut to be fastened to the machine bolt which is used for support of the meter. Where the meter-board is mounted on metal lath or other metal structure, all supporting screws or bolts must be countersunk. The dimensions of meter-boards and the location on them of meter-fittings of less than 200 amperes capacity, may be secured from the Commonwealth Edison Co.

Types and Dimensions.

1. Standard front-connected meters are provided for all alternating current installations. Current-transformers are used in connection with alternating current meters of a capacity in excess of 150 amperes. Current and potential transformers are required on all motor installations on primary lines.

2. Standard front-connected type of direct current meters are used up to a capacity of 150 amperes, 230 volts, 3-wire and 300 amperes, 230 volts, 2-wire. Meters of larger capacity, of either the front-connected or the back-connected switchboard type will be furnished.

Switchboard Meters.

1. Switchboard meters and their necessary equipment will be furnished by the Company for large installations if the customer makes arrangements with the Company in advance and provides for the necessary drilling and connections for both meters and their equipment. Demand meters, printometers, contact-making clocks, and relay switches are part of the meter equipment. Proper templates and wiring diagrams will be furnished by the Company.

2. Test-links must be installed with all switchboard meters. For 2-wire meters, two test-links are required, one in the service lead to the meter, and one in the load lead from the meter. For the 3-wire meters, four test-links are required, one in each of the service leads to the meter, and one in each of the load leads from the meter. Test-links should be located on the front of the switchboard. The meter test-links approved may be secured from the Commonwealth Edison Co. The test-terminals, studs, and links of an approved type only will be accepted by the Company and must be furnished and installed by the customer.

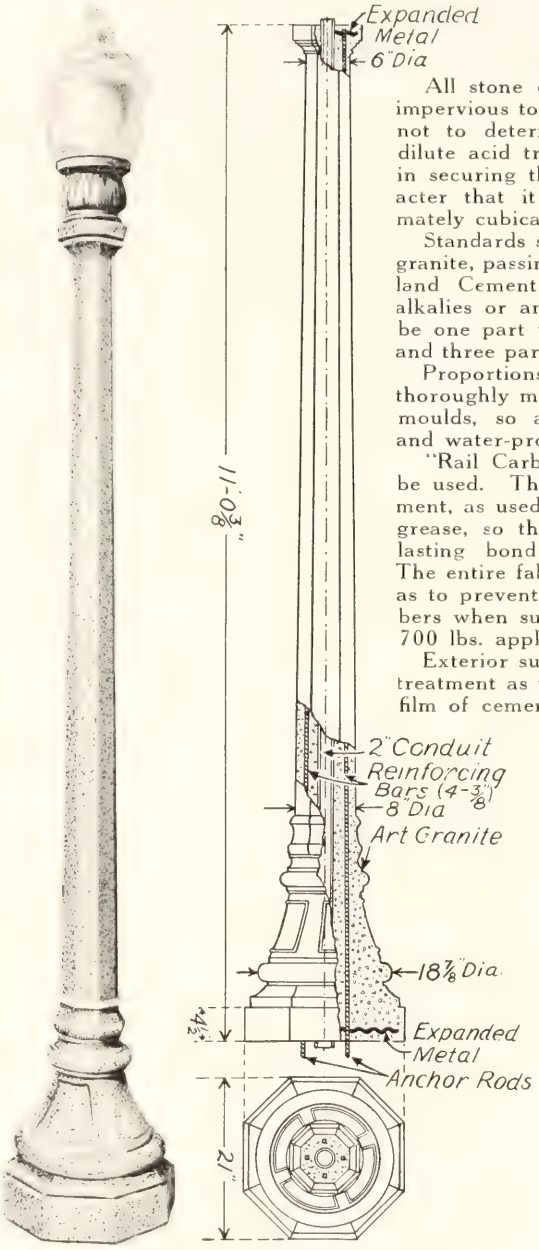
3. In all cases test-links must be readily accessible and must be placed at a distance of not less than 2 inches from any switches, bus-bars, switchboard-frame, or frame bolts, so as to eliminate, as far as possible, danger from short circuits in making connections for tests.

4. When current-transformers or other metering equipment are mounted at the rear of the switchboard, there must be left a clear space of not less than 30 inches between such current carrying parts and the wall, to permit free access to this equipment.

5. The fuses provided for protection of printometer and other demand meters must be mounted so as to be accessible without the danger of the Company's representatives coming in contact with live parts of the switchboard while replacing these fuses.

6. Various details, such as the method of metering, the type and capacity of watt hour meters and maximum demand meters, and the size of test-links, will be determined by the Company for each switchboard installation. These details must be taken up with the Distribution Division of the Company by the customer or his representative before the board is designed and sufficiently in advance of its construction to give the Company sufficient time to obtain the special equipment. Blue-prints or sketches showing the proposed location and connections of meters and equipment on switchboards must also be submitted to the Distribution Division for approval, before the switchboard is constructed.

Ornamental Concrete Lighting Standards



"THE CHICAGO BEAUTIFUL"

For commercial and other use—adopted by the Engineering Department—City of Chicago—plan 7919

Specifications

All stone employed shall be hard, dense, impervious to moistures, of such character as not to deteriorate, and not affected by a dilute acid treatment which may be applied in securing the proper finish; of such character that it crushes into masses approximately cubical in form, not into flakes.

Standards shall be constructed of clean art granite, passing a ¼ inch screen, tested Portland Cement and clean water, free from alkalies or any organic matter. Mixture to be one part white or gray Portland Cement and three parts of clean Art Granite or Spar.

Proportions must be accurately measured, thoroughly mixed and poured wet into metal moulds, so as to produce a homogeneous and water-proof material.

"Rail Carbon" steel reinforced rods must be used. The surface of all steel reinforcement, as used, shall be free from rust, oil or grease, so that there will be a perfect and lasting bond between concrete and steel. The entire fabrications are to be arranged so as to prevent buckling of compression members when subject to a concentrated pull of 700 lbs. applied at the post top.

Exterior surface shall be subjected to such treatment as will entirely eliminate the outer film of cement, leaving exposed the mineral crystals in their natural state.

Standards shall be cured for a period of seven days after casting, and no standards shall be moved for shipment or other transportation until twenty (20) days after casting. Finished standards shall have sharp and clean cut edges, true surfaces free from holes, cracks, lumps or other imperfections.

Metal conduit pipe is to be imbedded in center of these standards, extending from top plate to a point 2 inches below roof of lower hollow. Reinforcing rods are to project below base a distance equal to 20 diameters of bar, suitable for embedding in concrete foundations which are not part of this specification.

Lighting standards shall be so equipped that same can be used with either gas or electric light.

AMERICAN CONCRETE PRODUCTS CO.

30 North LaSalle St. CHICAGO, ILL. Telephone Franklin 4316

GAS FITTERS' RULES

Of the Peoples Gas, Light and Coke Company

OFFICE BUILDINGS, DWELLING HOUSES AND FLATS
MANUFACTURED GAS FOR LIGHT

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Preface

The following rules governing the piping of buildings for distribution of gas for light, fuel, heat and power, have been adopted by The Peoples Gas Light and Coke Company.

This Company reserves the right, at its discretion, to alter, amend or revoke these rules as may hereafter appear for the best interests of the Company and its patrons.

All gas-fitters' rules previously issued are hereby revoked.

It is the purpose of the Company to enforce these rules, and no certificates of inspection will be issued unless they are complied with.

General Instructions.

1. Inspection of piping. Piping must be inspected by the Gas Company after it is completed and before the interior of the building is lathed or covered. Twenty-four hours' notice will be required for inspection. Gas fitters must have the work completed and the piping tight before they notify the Gas Company to make inspection.

2. Testing. Before fixtures are installed, the piping must stand a pressure of 6 inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed, piping must stand a pressure of one inch on a column of mercury without showing any drop for the same period of time.

"You Can Afford to Heat with Gas"

Is the name chosen for an attractive book with pictures of representative Chicago homes, that were heated with gas last winter.

Actual costs are shown in this book, which was prepared after considerable research work on the part of house heating engineers.

A copy will be mailed you on request to Architects and Builders Service, Room 309, Peoples Gas Building, Michigan at Adams.

"If it's done with heat,

You can do it better with gas."

THE PEOPLES GAS LIGHT AND COKE COMPANY

Michigan Avenue at Adams Street

3. **Obstructions in pipe.** All piping must be free from burrs and other obstructions.

4. **Defective material.** Split pipe or fittings repaired with cement or lead must not be used. Caulked fittings must not be used.

5. **Material not allowed.** Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.

6. **Work Reserved.** This Company does not permit anyone but its own authorized employees to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections

7. **Resetting or Changing Location of Meter.** If, after a meter is once installed, the customer desires alterations in the house-piping, which would necessitate the disconnecting, reconnecting or changing the location of the meter, a charge will be made by the Gas Company for this work.

8. **Work Not Allowed.** Gas fitters must not do any underground piping outside of a building.

9. **Capping Outlets.** All outlets must be securely closed with iron caps until fixtures or appliances are installed.

10. **Piping on Outside Wall.** When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

11. **Piping on Masonry Walls.** All piping run on masonry walls must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

12. **Imbedding in Concrete or Cement.** When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

13. **Trapping Pipe.** To avoid trapping pipe gas fitters must grade it to riser or to drops, except as provided in rule No. [illegible].

14. **Breaking Sizes.** In every case where an extension is to be made, pipe must be broken at a point where the full size can be maintained.

No extension must be made from a pipe of a smaller size.

15. **Drops from Branch Lines.** Drops on branch lines should have a set of 4 inches and they must be dropped square. Outlets for side brackets may be either square bends or long drop ells. The use of nipples is prohibited.

16. **Back Pressure Valve.** When compressed air oxygen or any other mixture under pressure is used with gas, an approved safety back pressure device must be placed on piping to prevent pressure backing up into meter. Before connection is made to meter such device must be approved by the company.

17. **Connecting Appliances.** Fitters are particularly requested to see that gas burning appliances are connected solid with iron pipe, with the exception of portable appliances which may be connected by approved metallic tubing.

18. **Typesetting Machines.** A linotype or monotype machine must be supplied by a separate fuel run.

Rules and Tables for Piping.

19. **Understanding Rules.** If, in any instance, the rules governing the size of pipe to be installed are not clearly understood, or if unusual conditions not covered by the rules are met with, the Gas Company should be consulted.

20. **Single Pipe System.** The following tables and rules provide for a single pipe system in either new or old buildings. However, should it be more economical to install a double pipe system, such may be installed, and outlets computed on the same basis as that for a single pipe system.

21. **Fuel Only.** When piping is installed for illumination in either a new or old building, an outlet must me left for fuel.

If gas for light is not desired, a building may be piped for fuel only.

22. **Size of Pipe Required and Equivalents.** The amount of gas passing through a $\frac{3}{8}$-inch pipe under normal pressure is approximately 10 cubic feet of gas an hour. The capacity of a $\frac{3}{8}$-inch outlet has therefore been called an equivalent, and the table of pipe sizes below has been figured out on that capacity and is to be used in estimating the size of the pipe necessary to give an adequate supply of gas to an appliance.

For example, a range for a flat or residence requires five times the quantity of gas supplied by a $\frac{3}{8}$-inch pipe, or five equivalents.

Range for flat or residence....5 equivalents
Fireplace Appliance ....3 equivalents
Laundry Appliance ....[illegible] equivalents
Water Heater ....3 equivalents
Arc Lamp ....2 equivalents

The number of $\frac{3}{8}$-inch equivalents for any appliance not mentioned in the above table may be determined by dividing the total consumption per hour of that appliance by ten.

Consumption of gas-fired steam boilers may be obtained by assuming 80 cubic feet of gas per hour for each horsepower.

23. **Size of Opening.** To determine the size of the opening required when risers are connected at the meter end, the combined loads of the risers must be added together. (See table in Rule 25.)

24. **Size of Riser for Combined Lines.** When two or more lines of pipe are connected in order to be supplied by one riser, the riser must be of sufficient size to supply the combined load of all the lines. (See Rule 25.)

25. **Office Buildings, Schools, Hospitals, Residences and Flats, Under Single Pipe System.**

Size of Pipe in Inches	Feet of Pipe Allowed	Number of $\frac{3}{8}$-inch Equivalents allowed
$\frac{3}{8}$	30	2
$\frac{1}{2}$	40	4
$\frac{3}{4}$	60	10
1	70	15
$1\frac{1}{4}$	100	30
$1\frac{1}{2}$	150	60
2	200	100
$2\frac{1}{2}$	250	200
3	300	300
4	450	500

Notes: Any ceiling 20 feet high or over must have $\frac{1}{2}$-inch drops.

In a residence or a flat building, a $\frac{3}{4}$-inch outlet for a range in a kitchen may be used to supply two appliances, such as a range with a $\frac{3}{4}$-inch outlet extended full size, and a water heater or a laundry appliance with a $\frac{1}{2}$-inch extension.

"More Than A Basement"

Is the title of a book recently published by The Peoples Gas Light and Coke Company. It contains reproductions of drawings which were awarded prizes in the Architectural Prize Competition for a Modern Basement of a House.

The Competition was approved as to form and method of procedure by the Committee on Competition of the Chicago Chapter American Institute of Architects.

"If it's done with heat.
You can do it better with gas."

A copy will be mailed you on request to Architects and Builders Service, Room 309, Peoples Gas Building, Michigan at Adams.

THE PEOPLES GAS LIGHT AND COKE COMPANY

Michigan Avenue at Adams Street

26. Stores and Factories.

Size of Pipe Inches	Feet of Pipe Allowed	Number of ½-inch Outlets allowed
½	30	1
¾	60	8
1	70	12
1¼	100	20
1½	150	35
2	200	50

Notes: For stores the running line must not be less than ¾-inch to the last outlet.

Drop outlets for stores must be ½-inch in size.

27. Bracket and Window Lights. Thirty feet of ⅜-inch pipe will be allowed for bracket lights. The same length of ½-inch pipe will be allowed for window lights.

28. Piping Rooms in Rear of Store. When a store building with living rooms in the rear is supplied by one riser, the running line must be ¾ inch to the outlet for fuel.

29. Domestic and Industrial Appliances. Gas to be used at one point.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
½	80	4
¾	90	10
1	100	20
1¼	150	30
1½	200	40
2	250	60

30. City Ordinance on Water Heaters. The following city ordinance on the installation of water heaters is in effect since July, 1920.

"1902. **Permit Required to Install or Connect Gas Water Heaters.** No person, firm or corporation shall install or connect any hot water heater in any building or structure, for heating water in the same by the use of natural or artificial gas as fuel within the City of Chicago, without first having obtained a permit as hereinafter provided."

"1903 **Application — Permit — Fee.** Any person, firm or corporation desiring to install or connect any water heater in a building or structure for heating water for use in such building or structure by the use of natural or artificial gas as fuel, shall file with the Commissioner of Health of the City of Chicago, an application upon forms furnished by the Department of Health, containing the name of the applicant, the street number of the building in which the said heater is to be used (and if the building is an apartment building, the location of the apartment), the floor plan of the room, showing the proposed position of the heater, the location of the plumbing fixtures, the door and window openings, showing their dimensions, and the course of the gas duct or ventilating pipe to the outer air or to a chimney connection provided, however, that no such gas water heater shall be installed in any bath room or toilet room.

"1904. **Structural Requirements.** No person, firm or corporation shall install or connect any such heater unless it be provided with a metallic hood to which there shall be connected a suitable ventilating pipe not less than two inches in diameter, which said pipe shall extend to a chimney flue or to the open air in such a way as to carry off all escaping gases or fumes from such heater. In case such ventilating pipe shall extend to the open air, it shall be provided with a cap or cowl so as to prevent a back draft. Every such heater or gas oven shall be provided with a convenient and adequate means of access to the burners and heating surfaces, for the purpose of lighting and cleaning same. No such gas water heater shall be set closer to the floor than twenty inches, measuring from the top of the burner.

"1904a. **Automatic Instantaneous Gas Water Heaters.** All instantaneous gas water heaters, automatically controlled by pressure valve and thermostat, shall conform to the foregoing structural requirements, except that they may have pilot lights located entirely within the casing and arranged for continuous burning, and that they may be set with top of burners not less than eight inches above floor; provided, that every such heater shall be set on a non-combustible floor or a sheet metal mat or pan and that the walls behind shall be protected by a sheet metal covering to the height of the heater.

"1905. **Duty of Owner or Person in Possession of Heater.** It shall be the duty of the owner or person in possession or control of any building or structure where gas water heaters have heretofore been installed, to make such heaters comply with the requirments of this article, and it shall be unlawful for any person to use any such heater until it shall have been made to conform to the provisions of this article.

2. "This ordinance shall take effect and be in force from and after its passage and due publication."

31. Automatic Water Heaters. An automatic water heater must be supplied with a separate fuel run from meter to heater. This does not apply to what are known as Junior or Domestic Automatic Storage Heaters listed in the first column below. Large storage heaters must be supplied with a separate fuel run.

For sizes and lengths allowed see table below. For size of fuel runs to any heaters not listed below, run pipe one size larger than opening on heater. The length allowed may be ascertained from table in Rule 29.

Type	Style	Style	Style	Style	Style	Style
Humphrey	#5B-24 #5R-40	#20, #30, #2A, #50-66 #2C	#4, #3C, #4C	#6, #6C	#8, #8C	
Pittsburgh	#30-40	#40, #50, #60 #65, #50-66, #100	#4, #200 #300	#6, #400	#8, #500	
Rudd	#30-20 #30-40	#2½, #3, #50-66, #100	#4, #200, #300	#6, #400	#8, #800	
Bryant		#18, #24, 3 and 4 Sections	#30, #36, 5 & 6 Sections	#42, #48, #54, 7-8-9 Sections	#66, #78, #90, #102, 11-13-15-17 Sections	#114, #126, 138, #150, #162, #174 186, 19-21-23-25-27-29-31 Sections
Hoffman		#2½D, #3N	#4H	#6	#8	
Toombs		#3	#4			
Radke		#2½, #3	#4	#6		
Go-Ro		#3	#4	#6		
American			#4	#6		
Kompack	#18 #32					
Hoffman Domestic Storage System	#30 #40 #50					
Lovekin	#22 #28 #35 #45 #60					
Capacity Cu. Feet per Hour	70 or Less	70 to 200	200 to 300	300 to 450	450 to 760	760 to 1225
Size Pipe in Inches	½ to ¾	1	1¼	1½	2	2½
Feet Pipe Allowed	30 & 60	100	150	200	250	250
Separate Fuel Run Required	No	Yes	Yes	Yes	Yes	Yes

UNIVERSAL
GAS RANGES

3200 WEST, ON DIVERSEY BLVD.
Logan Realty Trust, Owners
B. Leo Steif & Company, Architects

THE *"Universal Gas Range Specification Catalogue,"* containing detailed gas range specifications and drawings will be sent on request. This catalogue was compiled especially for the use of Architects and Builders.

Savings in freight and crating costs—our prompt delivery—and direct factory Universal service is helping Architects and Builders solve their gas range problems.

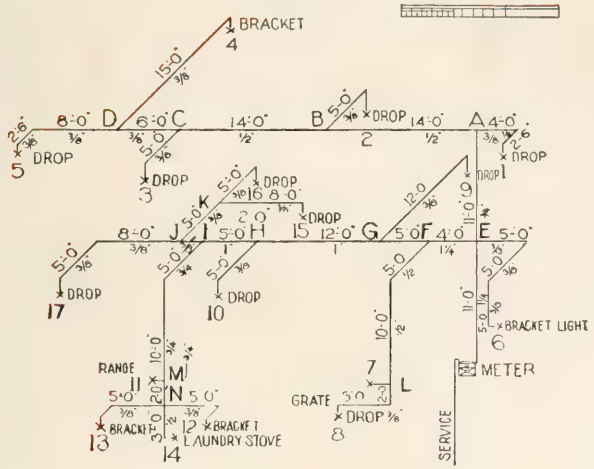
ADDISON SHORE APTS., 510-34 Addison
Realty Building & Construction Company
Architects and Builders

2322 LINCOLN PARK, WEST
Frank T. Mitchell, Owner
A. M. Johnson, Architect

CRIBBEN & SEXTON COMPANY
700 North Sacramento Boulevard, CHICAGO

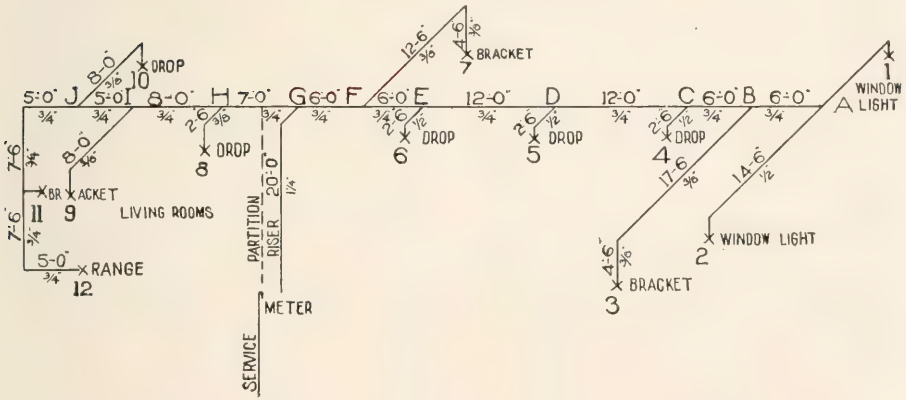
SAMPLE PIPING PLAN

RESIDENCE



SAMPLE PIPING PLAN

STORE WITH LIVING ROOMS IN REAR



32. Gas Engine. The gas supply for a gas engine must be separate. An independent service will be required, and a governing holder or other similar device acceptable to the Company must be used. Before any work of installing a gas engine or piping for one is done, consultation with the gas company is advised.

Horse-power	Size of Pipe in Inches	Feet of Pipe Allowed
1 to 7.....	1	100
8 to 12.....	1¼	100
13 to 22.....	1½	100
23 to 35.....	2	100
36 to 50.....	2½	100
51 to 100.....	3	100
101 to 150.....	4	200

Note: If the length of pipe required exceeds the number of feet allowed, the allowable length may be doubled by increasing the pipe one size.

33. Plans of Piping and Their Explanation. In determining sizes of piping for a building the starting point must be the extreme end of the system and all calculations must be made from there on to the meter.

Meter and Risers and their Location

34. Location of Meter. The Company reserves the right to determine in all cases the location for the meter.

35. Locations for Risers and Meters. All risers must be located to conform with the following requirements:

All meters hereafter installed on consumers' premises must be located in the basement, or on the first floor as near as possible to the service entrance in a clean, dry, safe place not subject to wide variation in temperature. No meter hereafter installed shall be placed in coal or wood bins or on the partition forming such bins or in any location where accuracy may be seriously affected by exposure to the elements.

The following locations are specifically prohibited:—Under a bulkhead or show-window, attic, sitting-room, bedroom, bathroom, bedroom closet, stairway closet, over a door or window under a sink or washstand.

Kitchen Maid Standard Unit Systems

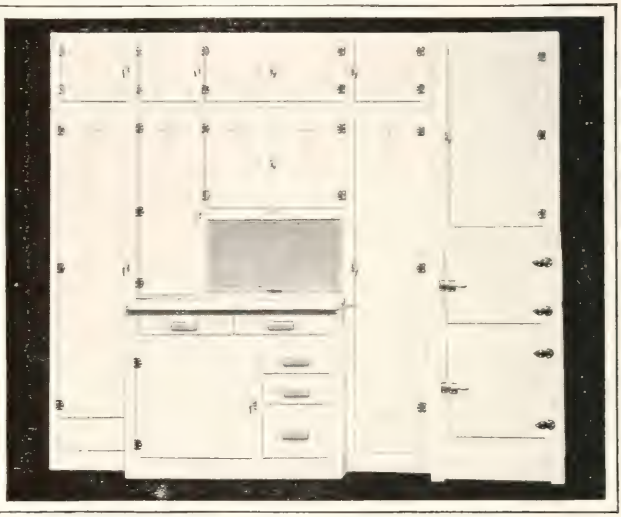
MANUFACTURED BY

WASMUTH-ENDICOTT COMPANY

ANDREWS, INDIANA

Chicago Representative **DRY FAST CO.**, 64 W. Randolph Street

Display Room 1515 Furniture Mart, 666 Lake Shore Drive



PRODUCTS.

"Kitchen Maid" Standard Units—including Kitchen Cabinets, Dish Closets, Linen Cupboards, Broom Closets, In-a-wall Ironing Boards, Refrigerators, Divider Cupboards, Pulmanooks, and In-a-wall Telephone Seats.

KITCHEN MAID STANDARD UNIT SYSTEMS.

The "Unit Idea" organizes the kitchen into a complete system of compact storage and working units, built to save labor, conserve floor space and utilize wall space. Each unit is complete in itself but is designed so that it can be used in company with one or more other units.

"Kitchen Maid" Standard Units meet the architect's demand for "flexibility." They can be grouped together against one wall or separated in different parts of the kitchen—exactly according to the kitchen plans.

CONSTRUCTION AND FINISH.

"Kitchen Maid" Standard Units represent the highest development of cabinet-craftsmanship. They are built from carefully kiln dried woods and are never shipped unless protected from humidity changes by at least two coats of white paint.

"Kitchen Maid" smooth door construction eliminates common panel doors. The doors are guaranteed not to warp or get out of line. All interior corners are rounded, leaving no space for dirt to collect. The smooth door construction and rounded inside corners make possible a new degree of cleanliness.

Units are finished in choice of white enamel, gray enamel, or two coats of flat undercoat. They are equipped with hinges, latches and other hardware that are rust-proof, substantial and practical.

Units cost no more than old-fashioned cupboards.

For complete information, dimensional drawings, etc., send for the new Kitchen Maid catalogue.

A COMPLETE "KITCHEN MAID" COMBINATION.

Above is shown all the necessary units of kitchen equipment on one wall space, in a complete Kitchen Maid combination. Kitchen cabinet, broom closet, dish cupboard, storage compartment, refrigerator, and a top cupboard which can be used as a package receiver. Many a full-sized pantry contains less actual usable space than this. The famous "Kitchen Maid" features of construction—rounded inside corners, and smooth surface, no-panel doors are carried out in all units. Included in this combination are Kitchen Maid Unit No. 210 Kitchen Cabinet; unit No. 70 Dish Cupboard; unit No. 11 Broom Closet; unit No. 0212 Top Cupboard; unit No. 58 Refrigerator and unit No. 59S Cupboard over refrigerator.

over a gas or electric light fixture or in any location where the visits of the meter reader will cause annoyance to the customer.

Plan No. 1. Residence.

Line	Number of ⅜-inch Equivalents supplied by line	Length	Size
5 to D	1	10′ 6″	⅜″
4 to D	1	15′	⅜″
D to C	2	6′	⅜″
C to 3	1	5′	⅜″
C to B	3	14′	½″
2 to B	1	5′	⅜″
B to A	4	14′	½″
1 to A	1	6′ 6″	⅜″
A to E	5	11′	¾″
J to 17	1	13′	⅜″
K to 16	1	5′	⅜″
K to 15	1	8′	⅜″
K to J	2	5′	⅜″
J to I	3	2′	½″
N to 14	3	3′	½″
N to 13	1	5′	⅜″
N to 12	1	5′	⅜″
N to M	5	2′	¾″
I to M	10	15′	¾″
I to H	13	5′	1″
H to 10	1	5′	⅜″
H to G	14	12′	1″
9 to G	1	12′	⅜″
G to F	15	5′	1″
8 to L	1	7′	⅜″
L to F	4	15′	½″
E to F	19	4′	1¼″
6 to E	1	15′	⅜″
E meter	25	11′	1¼″

Plan No. 2. Store with Living Room in Rear.

Line	Number of ⅜-inch Equivalents supplied by line	Length	Size
K to 12	5	12′ 6″	¾″
K to J	6	12′ 6″	¾″
10 to J	1	8′	⅜″
J to I	7	5′	¾″
9 to I	1	8′	⅜″
I to H	8	8′	¾″
8 to H	1	2′ 6″	⅜″
H to G	9	7′	¾″
2 to A	2	14′ 6″	½″
1 to A	2	9′ 6″	½″
A to B	4	6′	¾″
3 to B	1	22′	⅜″
C to B	5	6′	¾″
4 to C	1	2′ 6″	⅜″
C to D	6	12′	¾″
5 to D	1	2′ 6″	⅜″
D to E	7	12′	¾″
6 to E	1	2′ 6″	⅜″
E to F	8	6′	¾″
7 to F	1	17′	⅜″
G to F	12	6′	¾″
G meter	21	20′	1¼″

Meters shall not be set so close to any source of artificial heat as to subject them to a temperature exceeding 75° Fahrenheit. On all new installations a meter must be installed in a location where a temperature no lower than 40° Fahrenheit is maintained.

36. Risers in Laundries, etc. Risers may be run to laundries, furnace or boiler rooms, provided the risers are not placed closer than 10 feet to any appliance and in no case directly in front of a boiler or a furnace.

37. Riser for Theatre. A meter to supply a theatre may be set in a public meter room with other meters and may be supplied by the service supplying those meters.

38. Piping for Laundry Room. In a flat building where appliances, such as laundry stoves, driers, etc., are installed for the joint use of tenants, a pipe from each tenant's meter must be run to the laundry room and a header provided on the wall adjacent to the appliance. Each riser must be equipped with a lock-cock.

A metal tag with the flat number plainly marked thereon must be securely fastened to each cock.

One outlet for a light in the laundry may be taken from the end of the laundry header.

39. Vestibule Partition. A riser must not be run closer than one foot to a vestibule partition.

40. Electric Cut-off Box. A riser must never be brought to a point nearer than 5 feet from an electric cut-off box.

41. Riser in Other Apartment. A riser for one apartment must not end in another apartment.

42. Height of Risers. A riser must be placed at a height of not less than:

4 feet from the floor for openings up to 60 in number.

5 feet from the floor for 60 to 100 openings.

6 feet from the floor for any number over 100 openings.

No riser must be placed higher than 9 feet from the floor.

43. Distance Below Ceiling. A riser must extend not less than 1½ inches below a finished ceiling, or 2 inches below an unfinished one.

44. Exit Lights. When running pipe for exit lights in theatres, schools, amusement or assembly halls, the city building ordinance should be referred to.

45. Public Lights—3-Flat Building. In a three-flat building or over, outlets for vestibule, public hall and basement lights must be taken from an independent pipe, and an opening left on the building service so that a separate meter can be set for these lights. If so desired, the riser may be connected with a union, or a right and left coupling to the meter of the applicant who may wish to pay for the gas.

46. Public Lights—2-Flat Building. In a two-flat building the outlets for the vestibule and basement lights must be taken from a separate riser, the end of which must be located near the first floor riser so that these outlets can be connected. A separate outlet in the building service for the vestibule and basement lights will not be required.

Outlets.

47. Outlet for Fuel. If the pipe has been run under the floor, the outlet for fuel in a kitchen must be left 3 inches above the floor and two inches clear of the baseboard. If the pipe has been run overhead and down, the outlet must be left 3 feet from the floor and 2 inches clear of the finished wall.

48. Drops. Drop outlets in a residence must be produced 1½ inches below an unfinished ceiling, or ⅝ inch below a finished one. In a store the drop outlets must be produced 2¼ inches below an unfinished ceiling, and 1½ inches below a finished one.

49. Mantel or Fireplace. An outlet for a mantel or fireplace must be produced ½ inch above the finished bottom of the fireplace, 6 inches from the left hand side and 6 inches from the back.

Building Services.

50. Building Service Only. If it is desired to install a building service only in any building, instructions for size of pipe and openings to be left must be obtained from the district shop.

51. Size of Building Service. The size of the building service must in every case be determined by the size and number of openings.

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1	70	16
1¼	100	40
1½	150	80
2	200	120
2½	250	200
3	300	300
4	450	500

Note: All openings in a building service must be of the same size as that of the riser which in no case must be less than ¾ inch in size.

52. Building Service in Unheated Basement. A building service in an unheated basement must be graded to the street, and the tee left turned up so that any condensation forming in the pipe will run to the street and not to the meter.

53. Solid Wall Porch. In a building with a solid wall porch, the building service must be run to the front and then to the side wall.

54. Location of Building Service. When risers are located in the rear of a basement or in a room provided for that purpose, or on the various floors, the building service must be brought to within 18 inches of the wall through which the street service will be produced.

55. Wrapping Building Service. A building service run under an open porch and connecting the front and rear sections of a building, must be covered with mineral wool or steam pipe covering and boxed in.

56. Encasing Building Service. A building service laid through a masonry wall must be encased and the pipe left resting on the bottom of the casing with a 1½-inch clearance on top.

57. Opening in Building Service. The opening in a building service should always be on the left hand side of the riser which it is to supply, and 15 inches from it.

58. Building Service in Flat or Residence. A building service for a flat building, or a residence must be run overhead, and brought down in an inside partition, not less than 4 feet from an outside wall.

No building service must be run under a basement floor or under a first floor where there is no basement.

59. Building Service in Store. A building service in a store may be run overhead if the entire horizontal run of pipe can be graded to the street service. If not, it must be run under the floor.

When a building service is run overhead it must be brought down at least 4 feet from the front wall of the building.

60. Building Service Underground. When it is necessary to extend a building service underground from the front to the rear of a store or factory building, it must be encased in tile pipe with cemented joints.

61. Building Service Header. When it is necessary to set more than two meters together, a building service header must be supplied with an opening for each meter.

62. Building Services for Adjoining Stores. When it is desired to run two separate services in one trench for stores separated only by a partition, the building services may be run so that the street service for each store will come under doorway.

In such cases the Gas Company must be notified sufficiently in advance, so that services may be installed before floors are laid.

63. Bringing Building Service to Street Service. When the Company's service is into a building before the house-piping is completed, the building service must be brought directly over the street service.

64. Terminating Building Service. A building service must not be determinated in a coal hole or in any other place where it will not be easily accessible.

65. Test-pipe to Prove Work. Every building service must have a ⅜-inch test-pipe to which a gauge can be attached.

Service Pipe from Main to Building.

66. Main to Property Line. A service pipe will be run at the expense of the Gas Company from the main to the property line, except that customer will be required to pay for the replacement of pavement and sidewalk if it is necessary to open them.

67. Property Line to Building. Customer will be charged for the extension of service from the property line to the termination of service or to point where connection is to be made to the building service.

68. Service Beyond Front Wall of Building. When there are furnished rooms in the front part of the basement and the owner does not wish to have the building service appear in these rooms, it may be terminated outside of them.

The street service will be continued on the outside of the building to opposite termination of building service, provided that the pipe does not have to be laid in a space which is covered or to be immediately covered with cement.

69. Services for Stores. A building containing stores must have a separate service for each store, unless a public meter room or other public place on the floor or below that where the gas is to be used is provided.

70. Services for Apartment Buildings. In apartment buildings of 12 flats and under, only one Company's service will be required. This will make it necessary to connect the various building services supplying the groups of risers regardless of fire walls, and extend one building service to the point where the Company's service will come in.

In apartment buildings containing more than 12 flats, two or more Company's services will be allowed.

71. Services for Court Buildings. In a building which faces on a park-way or has a park-way or court in the center, the Gas Company will run one service in the court or park-way, and branch therefrom to supply the various building services.

The gas fitter may run building services through fire walls and connect them, but these must be extended as close to the front of the building as possible.

Any building service in a court building must not be terminated in a finished room.

72. Locating Service to Corner Building. To avoid complications when working on a corner building, the gas fitter should obtain from the Gas Company a written notice giving the exact location where the Company's service will enter the building.

73. Building in Rear of Corner Lot. A building on the rear of a corner lot must be supplied from the side street if a gas main is on that street. If not, it may be supplied either from the front building or directly from the main, whichever is the more practicable.

74. Building in Rear of Lot. When a building in the rear of a lot is to be supplied, a separate service should be used wherever possible. If, however, an independent supply is not practicable, the building service for the front building, if there is one, must be extended to the rear of the building, and of a size not less than 1½ inches so the rear building can be supplied from it also.

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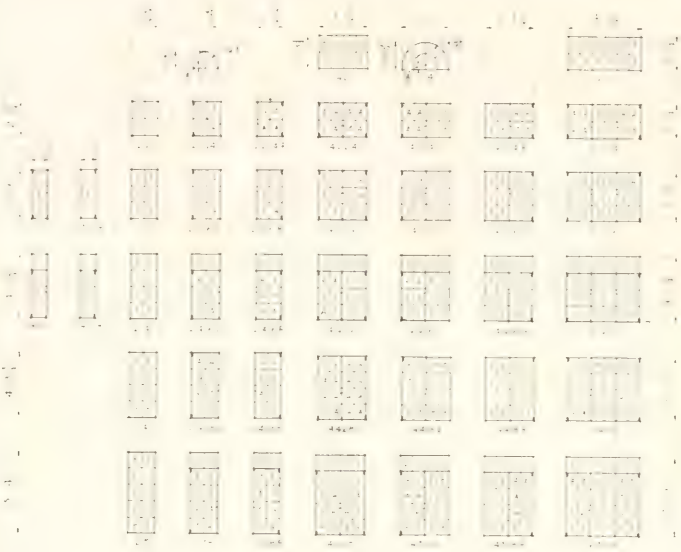

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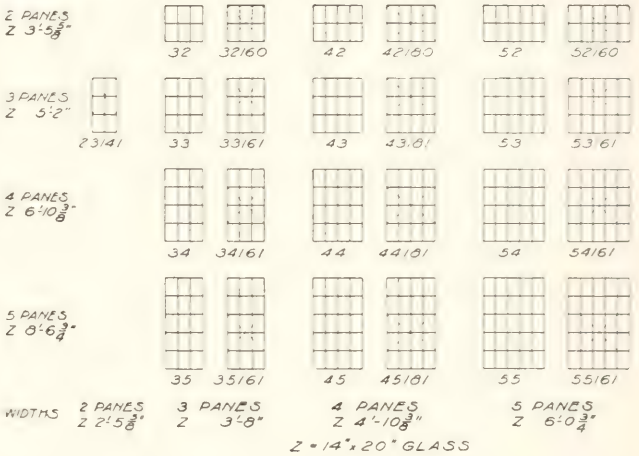

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In all cases where a supply to a rear building is desired the Gas Company must be consulted.

75. Two Services in One Trench. When two services are to be installed from a main in a paved or unpaved street to supply two (2) buildings under the same or different ownership, if these buildings are not more than fifteen feet (15 ft.) apart, such services may be run in one trench to a point inside the lot line, and then branched, one to the right and the other to the left, to the respective buildings, being sure that each service is laid in its respective lot.

76. Opening in Wall for Service. In a new building, an opening should be provided in the wall for the Gas Company's service. The most preferable way is to build a sleeve of wood, rectangular in shape, 12 inches by 5 inches, with an inside partition about 6 inches from the street end of the sleeve.

Application should be made to the Main Office of the Gas Company to locate the wall and the point in the wall wherein the sleeve should be built, so that when the service pipe is run, it will pass through the opening provided therefor. In this way the damaging of foundation walls will be avoided.

77. Opening in Floor for Service. When a service connection may have to be made above the floor level, an opening must be left in the floor so that the street service can be introduced. The district shop will, on notification, instruct the gas fitter where to leave this opening.

78. Reconnecting or Altering Service. If a building has been moved or altered necessitating the disconnecting, reconnecting or changing location of service, the work will be done by the company at cost.

Location of District Shops.

Following are the locations, boundaries and telephone numbers of the various district shops.

These numbers should be called when it is desired to communicate with shop inspectors.

North Shop. 1741 Kingsbury Street. Telephones—Diversey 5261 and 5262. Boundaries—North—City limits. South—Fullerton Avenue from river to city limits and 12th St. from river to Lake Michigan. East—Lake Michigan. West—The river from 12th Street to Fullerton Avenue and city limits from Fullerton Avenue North.

South Shop. 38 W. 64th Street. Telephones—Wentworth 1927 and Normal 8200. Boundaries: North—12th Street from Lake Michigan to the river and the river and canal from 12th Street to the city limits. South—city limits. West—city limits. East—Lake Michigan.

West Shop. 164 North Sheldon Street. Telephones—Monroe 0873, 3497 and 3498. Boundaries: North — Fullerton Avenue. South—Chicago river and the Canal. East—Chicago river. West—city limits.

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BASIC SPECIFICATIONS FOR TILEWORK

As Recommended by The Associated Tile Manufacturers

Second Edition, 1924

EXTENT OF WORK

(1) The following specification shall be known and hereafter identified as "Basic Specification for Tilework, Second Edition, 1924 as issued by the Associated Tile Manufacturers." It specifies how the work shall be done, beginning at the bottom of the concrete setting beds and at the back of the scratch coats, carrying each through to and including the finished tile surfaces.

(2) The location and extent of tilework together with the kinds, grades, sizes, colors and designs of the tiles shall be governed by the architect's drawings, specifications and schedules.

(3) All materials and labor necessary for the completion of the tilework shall be furnished in accordance with this Basic Specification except as modified, if at all, by the architect's drawings, specifications and schedules.

(4) Any such modifications, and the general conditions, and other provisions of the architect's specification, shall be accepted as conditions to this Basic Specification, and where conflicting, shall take precedence over it.

TILES

NOTE. See "Publication K-200" for Gradings, Shapes, Colors, Finishes, Nomenclature, and manufacturing conditions, also K400 "Glazed Tiles and Trimmers" for standardized caps, bases, etc., K500 "Ceramic Mosaic" for standardized patterns for fields, borders, trimmers, etc., of ceramic mosaic.

(5) **Samples:** If required in the architect's specification, typical samples of each kind and grade of tiles as specified and proposed to be used, and shop or setting drawings or rubbings, shall be submitted to the architect for approval.

(6) Each sample shall be marked with the name of the manufacturer and the grade of the tile. Approved samples shall be retained by both the architect and the tile contractor.

(7) **Grades and Certificate:** Before setting any tiles, the tile contractor shall furnish to the architect a certificate of grade, properly filled in on the Form of Grade Certificate of the Associated Tile Manufacturers. This certificate shall be signed by the manufacturer of the tiles; shall state the grade, kind and full quantities of tiles; and give identification marks for all packages of tiles furnished under this contract. Packages shall be branded with corresponding shipping marks and shall be subject to inspection by the architect or his representative before being opened

CEMENTS, LIME AND AGGREGATES

(8) All cement and hydrated lime shall be delivered in the original containers bearing the brand and maker's name.

(9) **Portland Cement:** All Portland cement (including white) shall comply with the Standard Specifications and Tests for Portland Cement of the American Society for Testing Materials, Serial Designation C-9-17, together with all subsequent revisions adopted by said Society.

(10) All white cement shall be white Portland of an acceptable brand of American manufacture.

(11) **Lime:** All hydrated lime shall comply with the Tentative Specifications for Hydrated Lime for Structural Purposes of the American Society for Testing Materials, together with all subsequent revisions adopted by said society.

(12) **Sand:** All sand shall pass an 8-mesh sieve and shall be free from organic matter, salt, or alkali, and if it contains more than 5 per cent by volume of material passing a 100-mesh sieve shall be well washed. All sand for concrete shall be graded from fine to coarse.

(13) **Crushed Stone or Gravel:** Crushed stone or gravel shall be hard and well graded from ¼" to 1" ring size. If loam or clay coat the particles, or are present to a greater extent than 5 per cent by volume, the stone or gravel shall be washed till not more than that amount is contained.

(14) **Slag:** Slag shall be clean, dense, crushed blast furnace slag, weighing not less than 70 pounds per cubic foot when loosely placed in the measure, and containing not more than 1.3 per cent of sulphur as sulphides.

(15) **Cinders:** Cinders shall be thoroughly vitrified, and shall be free from ashes, unburned coal or coke. Large lumps shall be broken up. All cinders shall be screened free from particles smaller than ¼" and shall be well washed. House ashes and cinders containing sulphur in any form shall not be used. (See Par. 17.)

NOTE: Where cinders or cinder concrete are used, it is recommended that metal plumbing and heating pipes be wrapped.

CONCRETE AND MORTAR

(16) **Concrete:** Concrete shall consist of one volume of Portland cement, two and one-half volumes of sand, and five volumes of gravel, crushed stone or slag, or shall consist of one part Portland cement and six parts of well graded coarse sand. At the option of the contractor, five pounds of hydrated lime may be added for each bag of Portland cement.

(17) Cinders may be used in place of gravel, crushed stone or slag, unless prohibited by the architect's specification.

(18) Thoroughly mix all cement and aggregates until the concrete is of uniform color and consistency throughout, using a minimum quantity of clean fresh water. Mixing may be by hand or by acceptable batch machine mixers.

(19) Concrete shall be spread promptly after mixing and shall be well compacted to uniformly rough surfaces at proper level to receive the setting mortar.

(20) **Mortar:** Sand, cement and lime shall be thoroughly mixed in the proportions hereinafter specified under Setting, Par. (57), until of uniform color and required consistency. Mortar shall not be retempered, and tile shall not be set in mortar that has reached its initial set.

METAL LATH, SHRINKAGE MESH AND PAPER

(21) **Metal Lath:** Metal lath shall be coated expanded metal, coated perforated metal, or coated wire lath.

(22) Lath on vertical surfaces where supports are not over 16" on centers and lath for ceilings, shall be metal lath weighing not less than 3.4 lbs. per sq. yard or wire lath not less than No. 18 gauge (.047" diameter), 2½ mesh to the inch.

(23) Lath on vertical surfaces, where supports are placed not over 12" on centers, shall be metal lath weighing not less than 3 lbs. per sq. yard, or wire lath not less than No. 20 gauge (.035" diameter), 2½ mesh to the inch.

(24) If the distance between the centers of the structural supports of any lath is more than 16", the lath behind the tilework shall be provided with stiffeners not over 12" on centers.

(25) Lath shall be stretched tight and shall be secured at all bearings with fastenings not more than 6" apart, as follows: To woodwork with not less than one 1" bright staple, or one six-penny bright wire nail; to metal furring with hammered prongs or twisted loops of wire; and to gypsum blocks and to masonry with specia.

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!y hardened steel nails or self-clinching nails. In driving staples or nails the lath shall not be flattened or damaged.

(26) Vertical joints in lath shall not occur except at structural supports, and shall there be lapped one full mesh. All horizontal joints of lath shall be butted, and laced or tied with wire, at least once between supports.

(27) **Shrinkage Mesh:** Shrinkage mesh where specified herein for use in concrete setting beds shall be No. 16 gauge, unpainted expanded metal of from 2″ to 3″ mesh, or galvanized wire fabric of one of the following sizes. Rectangular mesh: No. 8 gauge, (.162″ diameter) wire at 3″ centers crossed by No. 10 (.135″ diameter) wire at 8″ centers, or triangular mesh, No. 8 wire at 4″ centers, diagonally laced with No. 14 wire 4″ centers; or 4″x7″ hexagonal mesh of No. 10 gauge wire.

(28) Shrinkage mesh shall be placed well within the mass of the concrete setting bed and where more than one width or length is required shall be lapped not less than one-third of a mesh. The mesh shall butt against walls and partitions and shall not be turned up.

(29) **Building Paper:** Building paper shall be tar or asphalt saturated paper weighing not less than eleven (11) lbs. per sq. ft. It shall be lapped at least 2″ and, in connection with floors, shall be turned up at the walls at least 2 inches.

SETTING OF TILES

(30) **General:** All tiles shall be firmly secured in place. Joints shall be well filled, and lines shall be kept straight and true, and all finished surfaces brought to true and level planes. The completed work shall be free from cracked or broken tiles.

(31) **Borders and Patterns.** Where borders, lines, patterns, panels or other effects are a part of the work, the tiles shall be properly spaced, and shall accurately reproduce designs shown on the drawings or effects described in the specification of the architect.

(32) **Edges:** All intersections and returns shall be perfectly formed. All cutting and drilling of tiles shall be neatly done without marring the surface. The cut edges of tiles against any trim, finish, built-in fixtures, etc., shall be carefully ground and jointed. Around electric outlets, plumbing pipes, or fixtures and fittings, the tile shall fit close, so that the regular plates, collars or coverings will overlap the tile.

(33) **Laying Out:** All tilework shall be so laid out on floors and lengthwise on walls that, wherever possible, no tiles less than half full size shall occur. For heights stated in feet and inches, unless tilework is intended to exactly fill vertical spaces, courses shall be maintained full to produce nearest attainable height within a variation above or below equivalent to less than one-half course to avoid cutting of tiles which would otherwise be necessary.

(34) **Tile Packages Kept Dry:** All tiles shall be kept dry while in packages and shall not be allowed to lie in or upon wet sawdust or similar materials.

(35) **Soaking before Laying:** All tiles, except vitreous tiles and ceramic mosaic, shall be soaked in clean water before being set.

(36) **In Freezing Weather:** In freezing weather concrete setting beds or scratch coats or tiles shall not be placed in unheated portions of the structure.

NOTE: For Floating Method and Buttering Method of setting tiles see Par. (95), (97) and (98).

TILED FLOORS AND HORIZONTAL SURFACES

(Other than Ceilings, Soffits and Sills)

(37) **Concrete Setting Beds: General—** Concrete setting beds of stone, gravel or slag, or sand concrete, shall be 2″ thick, except that directly on earth or fills referred to in Par. (53) they shall be 3″ thick.

(38) Concrete setting beds of cinder concrete, Par. (17), shall be 2½″ thick, except that directly on earth or fills referred to in Par. (53) shall be 3″ thick.

(39) Where joists are chamfered, the point of the joist shall be at least ¾″ below the top of the concrete setting bed.

(40) The upper flanges of any steel beams projecting into concrete setting beds shall be covered with loose sheet metal or building paper to prevent adhesion of the concrete setting beds.

(41) All floor arches or slabs, and all wood floors, shall be swept free of loose particles before placing any concrete setting beds.

(42) The Contractor shall not install any tilework in floors of shower baths, except when located in basements, until a pan or safing of lead or other metal has been placed, turned upon all sides, and made watertight by other contractors. The finished surface of the tile floor shall be sloped to drain properly into the outlet.

(43) **Concrete Setting Beds on New Wood Construction:** Unless otherwise provided for in the architect's specifications, a layer of building paper, lapped and turned up, shall be placed over wood floors as described in Par. (29).

(44) Concrete setting beds shall be reinforced with shrinkage mesh as described in Par. (27) and (28).

(45) **Concrete Setting Beds on Old Wood Construction.** Where tile floors are to be laid over existing wood floors, the tile contractor shall cover the existing wood upper floor, or under floor, as the case may be, with building paper in accordance with the provisions of Par. (29).

(46) On the surface thus prepared a concrete setting bed, 1″ thick, composed of sand and cement as described in Par. (16), with shrinkage mesh as described in Par. (27) and (28), shall be spread. This concrete setting bed shall finish at such thresholds as are provided by the architect's specification, the thresholds being of sufficient thickness to receive a ½″ layer of setting mortar plus the thickness of the tiles. Where joists are chamfered, the point of the joist shall be at least ¾″ below the top of the concrete setting bed.

(47) **Concrete Setting Beds on Pressed Steel Construction:** In connection with pressed steel joist systems of floor construction, the metal reinforcement and concrete slabs will be furnished and placed by other contractors as a part of such systems. Mortar setting beds only shall be provided by the tile contractor, and shall be placed directly on the concrete slab, unless joists have been set as low as mentioned in Par. (48).

(48) If steel joists are shown or specified lowered for the passage of pipes, concrete setting beds of thickness and as specified in Par. (49) and (50) shall be provided.

(49) **Concrete Setting Beds on Concrete Slabs or Other Masonry Construction:** Concrete setting beds shall not be placed until the exposed surfaces of masonry floor slabs, arches, or other structural work, shall have been brought to the required level or surface for the concrete setting beds by other contractors, and not until such surfaces are free from mortar droppings, projecting joists, etc., and so they shall present comparatively smooth and even surfaces for concrete setting beds without any depressions, cracks, holes or open joints.

(50) On the surfaces thus prepared, spread the concrete setting beds in accordance with Par. (37) or (38).

(51) **Concrete Setting Beds on Other Concrete Over Earth or Fills: Interior**—Where concrete setting beds for tilework are to be laid on concrete which has been placed over earth or fills, the setting beds shall not be laid until the lower work is suitably prepared by others as specified for concrete

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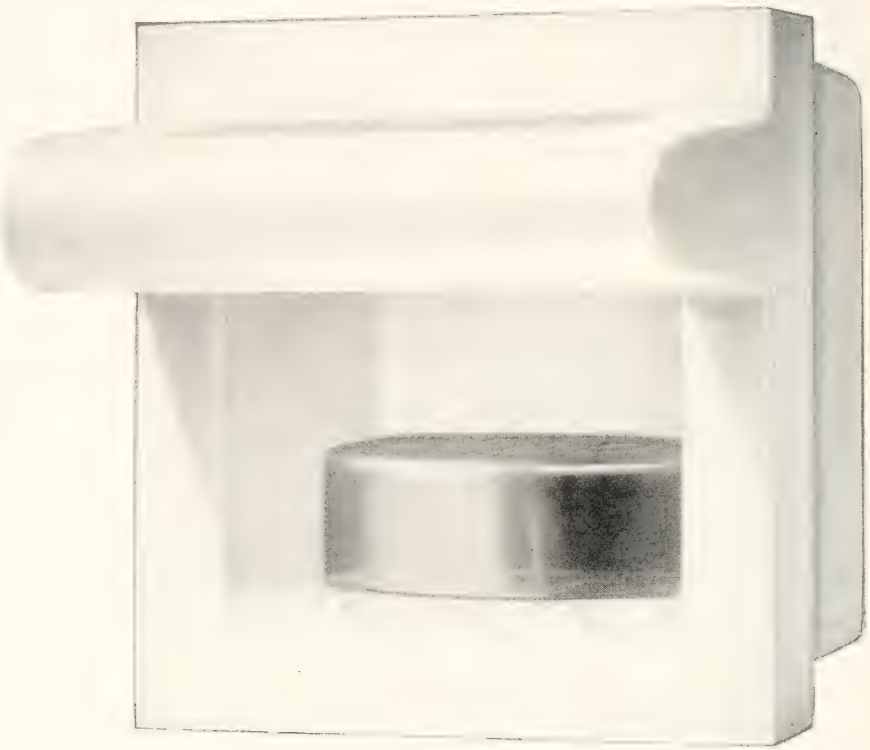

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slabs and other masonry construction, Par. (49). On the surface thus prepared, place concrete setting beds to the thickness specified in Par. (37) or (38).

(52) **Exterior:** Follow specifications for interior concrete setting beds, Par. (51), except that cinders shall not be used in the concrete.

(53) **Concrete Setting Beds Directly on Earth or Fills: Interior**—Where concrete setting beds for tilework are to be laid on earth or on fills of cinders, gravel or other materials, (sand cushions separately specified) without intervening slabs of concrete, the concrete setting beds shall be 3″ thick, of stone, gravel, slag or sand concrete, and shrinkage mesh shall be placed in these setting beds, in accordance with Par. (27) and (28). Cinders may be used in place of other aggregates unless prohibited by architect's specification.

(54) **Exterior.** Follow specifications for interior concrete setting beds, Par. (53), except that cinders shall not be used.

(55) **Cleavage Planes: Sand Cushion**—Where sand cushions are provided for in the architect's specification as a means of absorbing vibration or to afford a cleavage plane, a layer of clean sharp sand, not less than ½″ thick, shall be spread and thoroughly compacted to a smooth and level surface. Over sand cushions shall be laid a layer of building paper as described in Par. (29), ready to receive the concrete setting beds.

(56) **Building Paper:** Where so provided in the architect's specification, spread a layer of building paper in accordance with Par. (29), before placing concrete setting beds, to form a cleavage plane between concrete setting beds and surfaces underlying them.

(57) **Mortar Setting Beds:** Mortar for setting beds shall consist of one part Portland cement and three parts sand, and shall not be less than ½″ thick.

(58) Unless the mortar setting bed is spread the same day, or the day after the concrete setting bed has been placed, the concrete setting bed shall be thoroughly saturated with clean, fresh water, and its surface uniformly hand dusted with Portland cement immediately before spreading the mortar of the setting bed.

(59) The mortar shall be spread until the the surface of the mortar setting bed is absolutely true and even in plane, either level or uniformly sloped for drainage, as the case may be. For all surfaces over 100 sq. ft. in area, screed strips shall be set as temporary guides to assure these results.

(60) As large an area as can be covered with tile before the mortar has reached its initial set, shall be placed at one operation. When more setting mortar has been spread than can thus be covered, the unfinished portion shall be removed and cut back to a clean, bevelled edge.

(61) **Setting of Tiles:** Portland cement shall be uniformly hand dusted over the surfaces of the mortar setting beds immediately preceding the setting of the tile. The tiles shall be placed upon and firmly pressed and tamped into the mortar until exactly true and even with the finished floor lines.

(62) In the case of ceramic mosaic, the joints between the sheets shall be kept the same width as those between the mounted tile and set without showing where the sections join.

(63) Where the area of any floor is over approximately 100 sq. ft., the tiles or ceramic mosaic sheets shall be laid to a straight edge at regular intervals.

(64) Wherever borders or defined lines occur, they shall be laid before the field or bodies of the floors or spaces to be tiled, and the tile shall be set as before specified. The inner edges of all borders against fields or bodies shall be kept straight, and any cutting of tiles for irregularities in wall lines or vertical planes shall be done along the outer edges.

(65) Thresholds, if specified to be included, shall be set in a similar manner to borders, and if not included, the tilework of floors shall be brought to true lines, level with adjoining floors and stopped under doors, unless shown or specified to be continued into closets or other contiguous spaces.

(66) Hearths, unless otherwise detailed or specified, shall be set flush with the surface of adjoining floors. In connection with hearths and fireplaces, supply and set any ash drops, features, fittings, or other materials, specified or scheduled by the architect.

(67) Stairtreads, floors of shower baths, swimming pools, special hospital floors, and other surfaces not intended to be level, shall be sloped as detailed or directed for purposes of draining.

(68) Tiled nosings, coves, curbings, gutters, or other moulded or shaped features, shall be thoroughly backed or built up with mortar or concrete. They shall be rigidly placed, reinforced or otherwise made firm and secure. Tiled window sills and jambs, partitions, copings, or other similar features, shall be set as described herein under Tiled Walls and Vertical Surfaces.

(69) Where bath tubs are of built-in types, or extend to floors, the concrete setting beds over wood construction shall be continuous under them, and shall form close junction with all surrounding vertical planes. Tiling shall be omitted under such tubs, but under free standing tubs the tiling of floors shall be continuous to the surrounding tiling of vertical planes.

(70) As soon as the cement mortar beds have sufficiently set, the tiles on floors or other horizontal surfaces shall be well washed with clean water, and the joints between the tile grouted or jointed as mentioned under Par. (71) to (75) inclusive.

(71) **Grouting and Jointing:** The joints between all units of ceramic mosaic and between the abutting sheets, as laid, shall maintain the standard mounting width approximately $\frac{1}{16}$ inch.

(72) **Width of Floor Joints:** Unless otherwise shown, specified, or stipulated, the joints of other tiles shall approximate the following width, with uniform variance therefrom, either more or less, as may be desirable to cause the units, in the hands of skilled workers, to accommodate themselves to given spaces.

Vitreous and Semivitreous Tiles..... $\frac{1}{16}$″
Flint and Hydraulic Tiles..... $\frac{3}{16}$″
Plastic Tiles and Faience..... ¼″
Quarry Tiles..... ½″

Joints in the fields of walls and floors should not run straight through with the joints in the base and top mouldings, but should break in order to emphasize the different function of the moulding as distinguished from the field.

(73) All ceramic mosaic and other tiles set with close joints shall be grouted with Portland cement mixed with water to the consistency of thick cream. The grout shall be forced into the joints, sprinkled with dry cement and finished flush and true. All surplus grouting shall be removed and the faces of tiles left clean. In cases where acid solutions are required to clean the face of the finished tilework of surplus grouting or other particles of foreign matter, all hardware, such as hinges, cupboard trim, etc., shall be covered first by a coating of vaseline to protect the metal from the possible effect of acid fumes.

(74) All joints not grouted shall be completely filled with mortar consisting of one volume of Portland cement and two volumes of sand as before specified and, at the option of the tile contractor, tempered with hydrated lime to extent of not more than 10 per cent of the volume of cement and sand. All surplus mortar shall be wiped off and the faces of tiles left clean. White Portland cement, white sand, or mortar colors, in

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joints of tiles on horizontal surfaces—or fire clay for fireplace backs and jambs—shall be used only when and where so provided in the architect's specification or schedule and shall then replace the Portland cement or plain sand as here specified.

(75) After being cleaned as just described, floors, or horizontal surfaces in each room or portion as completed, shall be closed to traffic or work until the tiles are firmly set, Par. (118). After this, all completed tilework shall be finally turned over in clean condition as described in Par. (119), (120) and (121).

TILED WALLS AND VERTICAL SURFACES

(76) **Preparation for the Scratch Coat: General**—Scratch coats shall not be applied until substantial grounds, plugs and other provisions have been installed by respective contractors to receive plumbing fixtures, electric outlets, radiator brackets, or any other fixtures or fittings to be secured against tiled surfaces.

(77) In new construction work, when scratch coats are to be applied directly to concrete, brick, hollow building tile, stone or other masonry without furring, the masonry surfaces shall be thoroughly moistened but not saturated.

(78) In existing structures, where scratch coats are to be applied directly to masonry without furring, when such masonry has been previously coated with cement mortar or cement plaster, the mortar or plaster shall be removed, or hacked and wire-brushed in such a manner as to restore satisfactory suction for complete bonding of the scratch coat.

(79) Where such existing masonry has been coated with mortar or plaster containing gypsum or lime, the mortar or plaster, or any painted surfaces, shall be entirely removed and the masonry hacked and wire-brushed as just described. In lieu of removing or hacking and brushing, such existing surfaces, if conformable to architect's details, or if approved, may be metal lathed to comply with requirements of Par. (86) and (88).

(80) Scratch coats for tilework shall not be applied to new unfurred surfaces of concrete or other masonry construction until such surfaces shall have been brought to the required plane, plumb, reasonably straight and true, by other contractors, with the faces free of fins, excessive voids, or projecting joints, and left fairly rough, ready for the scrubbing specified in Par. (82).

(81) Old surfaces of concrete, brickwork or stone, if smooth, shall be hacked, roughened, or raked by the contractor applying scratch coats as may be necessary to provide satisfactory bonding for the scratch coats.

(82) Unfurred concrete to be tiled, whether new or old, shall be thoroughly scrubbed to clean the surface and give it additional roughness. At the option of the tile contractor this may be done by the use of wire brushes or by using muriatic acid diluted with 6 to 10 parts of water, scrubbed on until the aggregate is exposed, after which all traces of acid shall be removed by thorough rinsing.

(83) **On Wood Studding or Wood Furring:** On wood studding or wood furring to be tiled, furnish and attach building paper and metal lath as described in Par. (21) to (26) inclusive and Par. (29). This shall apply in the case of either old or new structures, as any existing lime or gypsum plaster shall invariably be removed by whatever contractor is specified in such cases; old wood lath to remain but shall be covered with metal lath.

(84) Where tiles form architraves of doors, windows, or medicine cabinets, trims of openings, or other features and bases, furnish and secure strips of metal lath as described in Par. (21) to (26) inclusive.

(85) **On Metal Studding or Metal Furring:** Where pressed steel studs, metal channels, tees, or other metal supports are used for partitions or furring, the metal lath in connection with same will be furnished and applied by other contractors.

(86) **On Gypsum Blocks.** Where tiles are to be set against gypsum blocks, furnish and place a layer of building paper; this is to be overlaid with stiffened expanded metal or stiffened wire lath as described in Par. (26), the lath to be secured in place by special anchorage or lacing as conditions require.

(87) **Alternate.** At the option of the tile contractor one heavy coat of asphaltum paint or other equal damp-proofing coat may be substituted for the building paper back of the metal lath before specified for use on gypsum blocks.

(88) **On Cork or Other Insulation:** Where tiles are to be set against cork or other insulation, furnish and attach metal lath as described in Par. (21) to (26) inclusive. In such installations, the scratch coat shall contain suitable proportions of an established brand of waterproofing compound mixed in accordance with manufacturer's directions.

(89) **The Scratch Coat:** A scratch coat shall be placed back of all tiles. The scratch coat on unfurred masonry shall be applied in conformity with Par. (76) to (82) inclusive. In all other cases, the scratch coat shall be applied to metal lath.

(90) Where bathtubs of built-in types are set against walls or partitions of masonry or gypsum construction, the scratch coat behind tubs shall be omitted below the undersides of rims. Against supports involving metal lath on wood, or steel studs, or furring, the scratch coat shall continue to and form close junction with concrete setting beds of floors. The tiling on all vertical surfaces in contact with built-in tubs shall abut the top of the rim, separated therefrom by a full width joint.

(91) The mortar for scratch coat shall consist of one volume of Portland cement and three volumes of sand. At the option of the contractor, hydrated lime may be added not to exceed 10 per cent of the volume of cement and sand, and plasterer's fibre or hair may be incorporated in the scratch coat.

(92) The scratch coat shall be ½" thick, or more if necessary, to make an even and true surface at the proper distance from the face of the tiles allowing for the thickness of the tile and for a ¼" bed of setting mortar for floating work and a ½" bed of setting mortar for buttered work. The scratch coat, at the option of the contractor, may be applied in two coats, instead of one.

(93) The scratch coat shall be applied not less than twenty-four hours nor more than forty-eight hours before commencing to set the tiles. While still plastic the scratch coat shall be deeply scored or scratched, horizontally, approximately 1" apart.

(94) **Setting of Tiles:** Immediately before setting tiles, the scratch coat shall be thoroughly moistened with water, but not saturated.

(95) On the surface thus prepared, the mortar for setting the tiles shall be applied in accordance with either of the methods described in Par. (97) and (98). In the absence of stipulations to the contrary, tiles may be set by either the floating or buttering method.

(96) Setting mortar shall consist of three volumes of sand and one volume of Portland cement, to which hydrated lime not to exceed one-tenth the volume of the cement and sand combined shall be added.

(97) **Floating Method:** Screeds or temporary guide strips shall be mortared plumb and true onto the scratch coat, to accurately indicate the surface plane of the mortar setting bed, which shall be rodded and floated flush with the guide strips. A skim of neat Portland cement shall be applied to the mortar setting bed or the back of each tile as laid. Each tile shall be beaten into place

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and brought flush in plane with the other tiles.

(98) **Buttering Method:** The scratch coat shall be spotted with small pieces of tile mortared plumb and true to accurately indicate the plane of the tiled wall when finished. Each tile shall be buttered and tamped in place and brought to a plumb and true surface, flush with the spots and with the other tiles. The back of each tile shall be completely covered with the mortar, bed at back of tiles shall be full and even, and all corners and crevices filled.

(99) **Fireplaces:** Tiles of fireplace facings or mantel breasts shall be set by either the floating or buttering method, but tiles of backs and jambs shall be set by the floating method unless shown or specified to be set flat, when they shall be tightly bedded against the surrounding masonry and set with full joists pointed on the face. Hearths to be as specified in Par. (66).

(100) **Inserts:** In the absence of stipulations to the contrary, any tile inserts indicated or specified, may be set by either the buttering or floating method.

(101) **Trimmers:** All caps, bases, coves, mouldings, or other trim tiles, shall be backed full with mortar, and tamped into place. The reference by the architect in his specification or schedule to any cap, base, quarter-round, bead, cove, combination tiles with cove corner or angles, or any moulded tile, shall be taken to carry with it the inclusion of all requisite returns, stops, angles, corners or other "trimmers" which are an established standard of the Associated Tile Manufacturers, incidental to the trimmers mentioned, and they shall be furnished and set by the tile contractor, as if especially called for.

(102) **Grouting and Jointing:** Vertical units and joints shall be maintained plumb and even, and all caps, bases, mouldings and horizontal units or joints shall be maintained level and even. Joints in the tilework of shower bath partitions, window jambs, alcoves or in returns to contiguous spaces, shall be maintained level and true with the joints of main fields. Every fourth course of tile shall be brought to a level and straight line. Wooden wedges, if used for this purpose, shall be removed before grouting is done.

(103) As soon as the mortar setting bed has sufficiently hardened, the tiles on walls or other vertical surfaces shall be well washed with clean fresh water and joints between tiles shall be grouted or jointed as mentioned under Par. (104), (105) and (106) unless otherwise stipulated. With the exception of the white Portland cement specified for joints of white tiles in Par. (104), white cement, white sand, or mortar colors, shall not be used in grouting or jointing, except when expressly so provided as mentioned in Par. (74).

(104) Joints in white bright glazed tiles shall be maintained at the customary size, approximately 3/64", and shall be filled with white Portland cement mixed with water to the consistency of thick cream. All traces of this grouting shall be wiped from faces of tiles before hardening, and all joints shall be left full and smooth.

(105) **Width of Wall Joints:** Unless otherwise shown, specified, or stipulated, the joints of other tiles shall approximate the following widths with uniform variance therefrom, either more or less, as shall be desirable to cause the units, in the hands of skilled workers, to accommodate themselves to given spaces.

Enamels, Vitreous and Semivitreous Tiles $\frac{1}{8}$"
Plastic Tiles and Faience ..... $\frac{1}{4}$"

(106) Where other kinds of tiles, including ceramic mosaic, are set on vertical surfaces they shall be grouted or pointed and left clean in accordance with Par. (71) to (74) inclusive, and (119) to (121) inclusive.

TILED CEILINGS, SOFFITS AND SILLS

(107) **Preparation for the Scratch Coat: On Hollow Building Tile**—When ceilings, soffits, or sills are to be tiled on unfurred hollow building tile, the provisions contained in Par. (76) and (77) shall be complied with before applying the scratch coat, which shall contain suitable proportions of an established brand of waterproofing compound, mixed in accordance with manufacturer's directions.

(108) **On Concrete:** The scratch coat shall not be placed on an unfurred concrete ceiling or soffit, but shall be applied to metal lath furnished and attached by another contractor.

(109) **On Wood Joists or Wood Stripping:** To the underside of new wood joists or new wood stripping, furnish and attach expanded metal or wire lath as described in Par. (21) to (26) inclusive. For existing wood joists or stripping Par. (83) shall be followed.

(110) **On Suspended Ceilings with Metal Supports:** Supports and metal lath for such types of construction will be furnished and applied by other contractors.

(111) **On Gypsum or on Cork or Other Insulation:** Preparation for scratch coat against gypsum, or against cork, or other insulation, shall be made in accordance with Par. (86), (87) and (88).

(112) **The Scratch Coat:** A scratch coat shall be placed back of all tiles, and be applied either directly to the hollow building tile as mentioned in Par. (107), or applied to expanded metal or wire lath, either furnished and attached by the tile contractor as described in Par. (109) and (111), or by other contractors, in accordance with the type of support, as mentioned in Par. (110).

(113) The mortar for scratch coat shall be as described in Par. (91) and shall be applied to conform to Par. (92) and (93) providing a $\frac{1}{4}$" mortar setting bed instead of $\frac{1}{2}$".

(114) **Setting of Tiles:** All tiles shall be set in mortar and in such manner as to comply with the descriptions in Par. (94) to (98) inclusive and with Par. (100) to (106) inclusive.

SWIMMING POOLS

(115) The tilework of swimming pools, or of Turkish bath, steam rooms, etc., shall be prepared for and set in accordance with the requirements of all other portions of the Basic Specification and in addition the mortar setting beds and joints shall contain suitable proportions of an established brand of waterproofing compound mixed in accordance with manufacturer's directions. When the walls and floors of swimming pools are not waterproofed, the scratch coats and concrete setting beds shall be waterproofed as specified for the mortar setting beds.

(116) Life rails shall be reinforced with properly shaped expanded metal and the high point shall be brought to an exact level on all sides of the pool. Scum gutters shall be formed in accordance with details and drained to the outlets with a high point between each pair of outlets.

ACCESSORIES

(117) The furnishing and setting of accessories such as andirons, grates, medicine cabinets, mirrors, recessed heaters, paper holders, soap cups, towel racks, shelves, etc., are not included, unless specified or scheduled as a part of the tile contract and listed in detail. When included, they shall be furnished, delivered and set by the tile contractor.

FINAL CLEANING AND RESPONSIBILITY

(118) The contractor shall post suitable notices or make other provisions to the effect that no one shall pound about freshly tiled walls or ceilings, nor walk upon freshly tiled floors, for several days after the tiles are set.

(119) **Cleaning:** Upon completion of the

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various portions of his work, the tile contractor shall remove all unused materials, rubbish, etc., in connection with this contract and shall give the tilework one thorough cleaning at the time of its completion. (See Par. 73.)

(120) After completion and cleaning in accordance with Par. (119) the obligation of the tile contractor shall cease as to any damage or injury which may be done to the tilework by others, and as to any further cleaning of the tilework upon final completion of the building as a whole, which additional cleaning shall be done only if so required by the architect's specification.

(121) **Responsibility:** Neither the final certificate nor payment nor any provision in the Basic Specification shall relieve the contractor of responsibility for faulty materials or workmanship, and he shall remedy any defects due thereto, which shall appear within a period of one year from the date of final completion of the structure, unless a longer date is stipulated in the architect's General Conditions or in his Modifications to this Basic Specification.

DEFINITIONS OF CERTAIN MATERIALS AND METHODS REFERRED TO IN THE BASIC SPECIFICATION

See Publication K-200 for other descriptive information

(122) **Buttering:** A method of setting tiles in which the back of each tile is "buttered" with mortar and then set in place. Floating is the alternate method.

(See Buttering Method Par. (98) and Floating Method Par. (97) in Basic Specification.)

(123) **Cleavage Plane:** A layer of material such as sand or building paper, used under certain conditions to separate the concrete setting bed from the under slab or other structural support. This is intended to allow for possible independent movement of the two planes.

Concrete Setting Bed—See Setting Beds.

(124) **Floating:** A method of setting tiles by beating tiles onto the fresh surface of the mortar setting bed. It is the method used for setting mounted sheets of tile, and is the alternative of the buttering method for setting unmounted tiles.

(See Floating Method Par. (97) and Buttering Method Par. (98) in Basic Specification.)

(125) **Grouting:** The method of finishing the joints of tilework in floors, walls, etc., by filling with a mixture of cement and water of the consistency of thick cream. This mixture is called a "grout."

(126) **Hydrated Lime:** Powdered lime resulting from the factory hydration of quicklime. It is delivered in bags as distinguished from quicklime, which latter—in lumps of granular form—requires hand slaking. A standard paper bag of hydrated lime weighs 50 lbs. and in volume is equal to about 1¼ cu. ft.

(127) **Inserts:** In the Basic Specification this term refers to isolated or grouped tiles set in a finished surface of other material such as brick, stone, stucco, concrete, or cement, whether on interior or exterior walls or floors. It includes bands and borders as well as panels and accentuation spots.

Mortar Setting Bed—See Setting Beds.

(128) **Mounted Tiles:** For accuracy in setting as well as convenience in handling certain small tiles are mounted on paper pasted to the face of the tiles. These mounted sheets are set as units by the floating method. The paper is soaked and removed after setting.

(129) **Sand Cushion:** A layer of sand sometimes placed under the concrete setting bed to a tiled floor to insulate it from the structure, thereby tending to prevent vibration due to machinery in motion, wind stresses, etc., from being transmitted to the tiled surface, as well as to minimize the possibility of structural cracks appearing on the surface.

(130) **Scratch Coat:** The Portland cement plaster forming the backing for the setting mortar of tiled walls and ceilings. It is scratched, scored, or grooved, to give key for the mortar setting bed.

(131) **Screeds or Screed Strips:** A wooden strip, or a strip of mortar laid on a floor or wall at intervals, to gauge the thickness of setting beds, or to indicate the finished tiled surface.

(132) **Setting Bed, Concrete:** The term Concrete Setting Bed, as used in the Basic Specification, refers to a layer or bed of concrete under a tiled floor or other horizontal tiled surface. This does not come in contact with the tiles, but serves as a foundation on which to apply the setting mortar. It is sometimes known as the underfill or base.

(133) **Setting Bed, Mortar:** Wherever tiles are to be set, a layer of mortar is applied, known as the Setting Mortar or the Mortar Setting Bed. Into this the tiles are beaten when set by the floating method.

(134) **Shrinkage Mesh:** A layer of expanded metal or wire fabric, of a large mesh. Its use tends to prevent cracking of setting beds due to contraction and expansion when affected by temperature changes or due to cracks or settlements in structural supports from other causes.

(135) **Trimmers:** The terms Trim Tile and Trimmers are used interchangeably to designate bases, caps, corners, angles, architraves, and other tile mouldings and shapes, as made and standardized by the Associated Tile Manufacturers to suit the various kinds, grades, and sizes of tiles.

TILES

The word "tile" has its origin in the Anglo-Saxon "tigel," which in turn is a derivative of the Latin "tegula," from tego, to cover. Although since appropriated to designate other products made in all sorts of shapes and from all kinds of raw materials, the term "tile" without other qualifying words or phrases still properly applies to those examples of the ceramic art which are used as a surfacing or finish for floors, walls, and ceilings for decorative and sanitary purposes on the interior or exterior of buildings.

INGREDIENTS AND PROCESSES.

Tiles are made either from natural clays or from different kinds of clays, feldspars, and flints which are obtained from domestic banks and quarries or imported from other countries, and are selected, proportioned, and mixed according to the kind of tiles to be manufactured. These raw materials undergo a variety of refining and mixing processes before they become suitable for forming or pressing into tiles.

According to the process used, tile makers

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distinguish between tiles made from the materials in the plastic state and those pressed by means of machinery from the pulverized and practically dry materials—the "dust," as it is called. Thus, in the one case, the tiles are made "plastic;" in the other case they are "dust-pressed."

Such tiles as Faience are made by the plastic process, and such tiles as Vitreous Tiles and the "bodies" of Glazed Tiles are of the dust-pressed type.

The Plastic Process:

In this process, the clays are mixed with water and run through pugging machines until of a uniform plastic consistency. In this condition they are pressed either by hand or machine in dies or moulds, and after drying out are put into burned clay containers known as saggars, in which they are sent through the kilns and fired. The plastic nature of the materials has a tendency to produce tiles that vary slightly from the true geometric shapes and bring about the pleasing irregularity characteristic of plastic-made tiles.

The Dust-Pressed Process:

In this process, the materials, after being finely ground and mixed with water, are passed into filter presses where the excess water is pressed out.

The resulting mass is dried and pulverized and then pressed into shape in metal dies. Every piece is inspected, fettled if necessary to remove feather edges, and is then placed in the saggars and sent through the kilns. The tiles in this unburned state are called "green" tiles.

FIRING AND GLAZING.

All tiles undergo one or more firings at high temperatures in kilns.

Unglazed Tiles:

These are produced in one firing which brings them to their respective degrees of vitrification, colors, and surface textures.

The colors in unglazed tiles are produced either by the selection of clays that will burn to the desired colors, or by the addition of certain oxides, such as the oxides of cobalt, chromium, etc. It lies in the nature of the raw materials and color ingredients that some can be fired to complete vitrification, while others do not permit this because physical destruction of the product would result. Consequently, the unglazed tiles are burned either vitreous or semivitreous, according to their colors as listed in the Schedule. Kidder's Handbook describes the vitreous as "the hardest tiles known, cannot be scratched by steel or sand, and are non-absorbent and thoroughly aseptic."

Glazed Tiles:

The "green" tiles, which ultimately are to be given a glazed surface, are first fired in the biscuit kiln at a temperature of over two thousand degrees Fahrenheit.

This firing produces the "biscuit," "bisque," or "body," made either plastic or by the dust-pressed method. This biscuit is subsequently coated with the glazing liquid, made from pulverized flint, feldspar, clay, and a flux, and is placed in the gloss kiln, where it is subjected to slightly lower temperatures which produce the glaze and unite it with the biscuit.

The resulting silicious coating is known by the generic term "glaze," and manufacturers technically differentiate between glazes, enamels, and dull finishes according to the ingredients and characteristics of the coating.

Trade custom, however, has extended the application of the word "enamels," for instance, to designate a kind of tiles; namely, those having a white body and a **bright finish colored** glaze. On the other hand, the same kind of tiles with a **colorless** glaze are commonly called White Glazed Tiles. Conversely, the white tiles generally used for wainscots in bathrooms are called Glazed, and the same tiles with a colored glaze in a bright finish are spoken of as Enamels.

Both glazes and enamels are entirely vitreous coatings.

Colors:

The colors of Dull and Matt Glazed Tiles and Faience are produced by various metallic oxides which stain the base or flux of the glaze while it is in a state of fusion. Certain color effects, praticularly in Faience, require more than one firing. In such cases the temperature of the kiln has to be changed or adjusted to different fusion points at which the ingredients of the successive glazings develop the various colors.

An important practical property of all colored glazes and enamels is that of being entirely non-fading.

The range of colors and tints is almost unlimited and virtually any color effect or combination can be obtained.

Surface Treatment:

The glazes and enamels are so proportioned and so fired that, as predetermined by the effect desired or texture to be obtained, the surface will result in a bright, dull, or matt finish. The bright have a surface of high gloss, the matt are entirely devoid of gloss, and the dull finishes lie intermediate between these extremes. Finishes such as eggshell, vellum, orange skin, crocodile skin, crystalline, etc., are varieties of the dull and matt, and present an extensive line of surface textures.

CRAZING.

This is the term given to minute crackling which sometimes becomes visible on the surface of glazed ware.

Tiles cannot be guaranteed against crazing.

In former years, manufacturers were willing to guarantee glazed tiles aginst crazing. This, however, is not now done or required, since producers and specification writers alike realize that crazing of a glazed surface cannot be absolutely controlled.

One of the causes of the phenomenon known as crazing is the slightest kind of a

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difference in the coefficients of expansion and contraction between the materials of the body and those of the glaze.

Other more frequent causes of crazing have been traced to unequal settlement and to the expansion and contraction of foundations, as well as to physical and chemical changes which may take place in backgrounds and foundations upon which tiles are set.

SORTING AND GRADING.

Tiles are not, and cannot be, manufactured in predetermined grades or qualities. The object of the makers is to produce but one grade, viz., the highest obtainable with the materials and forces at their disposal. But, because of limitations in the processes and the difficulty of absolute control in firing conditions, certain variations in shades, sizes, etc., take place which are inherent in the maunfacture of clay products.

Tile makers therefore sort the tiles, after they come from the kilns, into different grades which experience and the requirements of the consumer have established as expedient. With respect to wearing and sanitary qualities no difference exists in these grades, as surface blemishes, warpage, and appearance alone are the basis for the grading.

The sizes and thicknesses tabulated in the Schedule and shown by the drawings for various kinds of tiles should always be considered as subject to slight variations, or "tolerance," as in the case of all clay products, since the materials and forces of nature employed in their production are not susceptible to complete control.

Grades should be considered from the appearance of the tiles in the mass, since no single tile can be truly representative of any particular grade.

Shading:

The exact shade of tiles depends largely upon the degree of heat to which they have been exposed in the firing, and as absolutely uniform heat cannot be maintained in all parts of the kiln, necessarily there results a very slight difference in the shade, detectable only by the trained eye of the sorter. Manufacturers, in addition to grading, therefore, separate White Glazed Tiles so that each "lot" is of practically the same shade.

Grading:

The gradings in tiles are the natural consequence of relative productivity, which varies with the different kinds of tiles according to materials and processes involved. In White Glazed Tiles three classifications result. In Enamels the production results are divided into two classifications. In the case of Vitreous Tiles, the nature of the basic materials and the processes are such that while two grades result, the Commercial grade is of relatively small proportions, and should therefore be only sparingly specified. In the Semivitreous, the tiles other than Selected are so few in number that they are not marketed.

White Glazed Tiles:

These are graded and marketed under three classifications — Selected, Standard, Commercial. Each grade has its legitimate uses. The tiles that are as nearly perfect as it is possible to manufacture are chosen, and marketed as Selected for use in the finest class of tilework. The Standard grade is the one suitable for use in the greatest number of cases, as the term implies. The Commercial grade finds extensive use where economy, service, sanitation, and light-reflecting qualities are required and where manufacturing blemishes are of secondary importance.

Enamels and Vitreous Tiles:

These are marketed in two grades—Selected and Commercial. The Selected in these, as in the White Glazed Tiles, are as nearly perfect as it is possible to manufacture for use in the finest class of tilework. The Commercials similarly are marketed for purposes where economy, service, and sanitation are required, and where manufacturing blemishes are of secondary importance or contribute to the effect desired. In the Vitreous Tiles, but few of the Commercial grade are available, as before mentioned, and the Semivitreous Tiles are marketed in one grade only, Selected.

Workmanship:

Tilework is judged according to its appearance after being set in place, and the skill of the tilesetter plays almost as important a part as the tiles. An indifferent unskilled workman may not be able to produce so good a finished effect using Selected as a skilled setter will by using Standard tiles. It is well to bear this in mind in connection with specifications and supervision.

KINDS OF TILES.

According to their intended uses tiles are often referred to as floor tiles, wall tiles, etc. These terms, which have found their way into the nomenclature of the industry, do not invariably indicate limitations of use; for example, floor tiles may be and frequently are used for walls. Ceramic Mosaic, made originally for wearing surfaces of floors, is also largely used for vertical surfaces.

The production of special sizes and shapes in dust-pressed tiles involves special dies and handling, and deviation from the regular routine of manufacture. In Plastic Tiles and Faience, however, special shapes may be produced without distinct departure from the methods of production common to the regular tiles.

Trim Tiles, or Trimmers:

For use as bases, caps, corners, mouldings, angles, architraves, etc., certain shaped tiles are made to match the unglazed or glazed field of tilework. These are designated by the term Trim, or Trimmers. The range of shapes obtainable in these trimmers is extensive enough to meet any decorative or utilitarian demand.

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CHICAGO FOUNDATIONS

By F. E. BROWN

License Structural Engineer, M.W.S.E.

The soil underlying Chicago is mainly blue clay. Borings and excavations at various points give varying logs. At some points there is a considerable amount of sand overlaying the clay, but in most any location we can be quite certain that before any great depth is reached blue clay will be found. In general then our foundation problems in Chicago are concerned with a clay soil.

This clay varies in water content or hardness, but in general no very hard or stiff clay is found close to the surface, although there is supposed to be some additional stiffness to the clay at approximately the datum line and this has often been referred to as the upper crust. This is especially true in the down town district. In the earlier days all buildings were placed on so called floating, or raft foundations, now generally referred to as spread foundations. These were designed on the assumption of an upper crust of stiffer clay and the bottom of the foundations were kept high in order to put the bearing on this upper crust. This accounts for the shallow basements in so many of the older buildings.

The buildings of the earlier days were generally designed with a full knowledge that settlement would occur. They were built and an allowance made for such settlement. Many such buildings have settled more than was originally allowed for. There are a number of the older, heavier buildings that have settled amounts varying from 6″ to 24″. Had building continued on the former basis without deep foundations and deep basements, some of the settlement would probably not have been so great. It is hard to say how much of these settlements are due to the construction of caissons and deep basements on adjacent property; undoubtedly a considerable amount, because whenever there are caissons or deep basements constructed on adjacent property we expect, and get, additional settlement of such buildings.

It is to be noted in connection with these older buildings that considerable skill was shown by the designers in estimating the probable settlement and in so proportioning the foundations so as to make the settlements uniform. Of course, there are some of these old buildings that have not settled uniformly. Some are considerably out of plumb, but, so far, no serious trouble has resulted.

With the coming of the modern type of building with deep basements and caisson foundations, our problem changed. There are today in general use in Chicago three types of foundations. Our problem becomes first, one of selection of type of foundation for given case. That is—will the foundation be spread, pile or caisson.

In making this selection we must consider first, of course, local conditions on the particular site in question; we must consider the character and type of building, depth of basement, height and probable life. Then, we should consider the probable developments of adjacent property during the life of the building. If we are to use spread foundation, we should consider the probable expense that may be expected in connection with future operations on adjacent property.

Sometimes, in making the selection the first cost is given too much consideration and not enough attention is given to the probable development of adjacent property and future expense, or to the effect on the strength of the building in case settlement results from adjacent construction.

On all new buildings with spread foundations there is probably more settlement than is generally supposed. This is true to a lesser extent for pile foundations. Such settlement occurs partly during the construction and the building adjusts itself to such settlement before completion.

In connection with such settlement, it may be said that a building of ordinary construction, or possibly one of steel frame, will adjust itself more readily to unequal settlements than one of reinforced concrete. On the other hand, that a reinforced concrete frame, being monolithic, will tend to transfer loads and equalize the settlements, but in doing this what is the effect on the structure? It may very well be serious.

Where spread foundations are used every effort should be made to design so that the settlement will be uniform. There have been cases where unequal settlement has been disastrous to buildings.

There are also buldings of reinforced concrete that have settled unequally without serious effects. One such is a four-story building in another city but on a clay soil of a similar nature to that found in Chicago. Spread footings were designed for this building, but on excavation the bed of an old stream was found crossing one corner of the lot, with fill and muck for a considerable depth before satisfactory clay was encountered. This depth was so great that it was deemed necessary to use piles in this corner. The foundations for a large part of the building had already been placed before the necessity for this change was discovered. The building was approximately 400′ long. As was expected the spread footings settled more than the piles. Records were kept on the settlement during construction and for some time after completion. It was found that the settlement was a minimum next to the piles, with a gradual increase in the amount of

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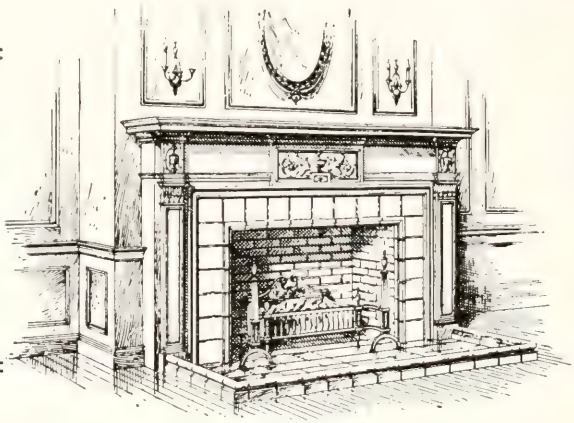

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settlement towards the middle of the building, where the maximum settlement occurred. The settlement then decreased towards the opposite end. This settlement took place gradually and mostly during the construction of the building, as very little settlement was noted after the building was finished. No cracks showed up in the reinforced concrete structure, or in the brick work. In fact but one crack was noted, and that was in the basement wall between two columns where one was on piles and the next on spread footing.

In another case, this one in Chicago, a tall, narrow building was built on spread foundations that were combined crosswise of the building, so that the entire building rested on a series of foundations crossing the building. This building settled more on one side than on the other, so that it was about 1½" out of plumb at the top. This occurred mostly during construction. So far as is known, while there may have been additional settlement after completion of the building, it was apparent there was no more unequal settlement and there were no signs of the effect of such settlement on the structure.

The question is often asked what is the height limit in number of stories for spread, or pile, foundations. No hard or fast rule can be made as one must consider the points already mentioned in connection with the picking of the type of foundation; but as a general rule, for the Chicago downtown district this may be put as follows: Spread foundations for buildings up to six (6) stories in height. Pile foundations for buildings up to twelve (12) stories in height and over twelve (12) stories, caissons or piers to hardpan or rock. There are, of course, cases where higher buildings than suggested here have been used on either spread or pile foundations.

Maximum pressures that can be used on soil in Chicago are fixed by Ordinance, but the designers must decide whether the soil on a given site is capable of taking the maximum allowed.

With reference to so-called hardpan we have no definite guide as to the amount of pressure to allow. Caissons, or concrete piers, resting on hardpan that have been used are with unit pressures varying from 10,000 to 15,000 pounds per sq. ft. with some effort on the part of the City Building Department to limit this in recent years to 12,000 pounds per sq. ft. The so-called hardpan in Chicago is more properly defined as hard clay. It varies considerably in hardness in different locations. In some places it is no more than stiff blue clay. The allowable pressure should certainly vary according to the hardness of the material at a given point and, also, consideration should be given to the thickness of the strata and to the underlying material.

Some time ago an effort was made to obtain data with reference to this so-called hardpan with the idea of estalishing some definite standards of practice. So far nothing conclusive has come from this. This investigation should be continued and some definite practice established.

In reference to the practice in designing concrete piers generally referred to as caissons, years ago many caissons, or piers, were built of concrete of a 1-3-5 mix using a pressure of some 300 to 350 pounds per sq. inch on the concrete. Later a 1-2-4 mix became standard with a pressure of 400 pounds per sq. inch allowed at the bottom of the shaft. Still later the City Building Department ruled that with a 1-2-4 mix 400 pounds per sq. inch would be allowed at the top of the pier and this is the practice at present. However, present day practice tends towards the richer mixes—that is, towards 1-1½-3 mixes with 480 pounds per sq. inch on the top or 1-1-2 with 580 pounds per sq. inch on the top. The use of the richer mixes will keep down the size of the caissons and be more economical. This is perhaps not true of the smaller caissons, but is particularly true of those 5′ and over in diameter. That is to say that where sizes of over 5′-0" are required, using the 1-2-4 mix, it will be found more economical to use a richer mix and higher pressure and keep down the size.

In connection with this richer concrete and higher pressure allowance on the arbitrary mixtures by volume, attention should be given to the possibilities of concrete mix on a basis of water cement ratio. Undoubtedly, some of our concrete is mixed with too much water and we do not get the ultimate strength we count on. Concrete of the proper consistency obtains strength much in excess of the ultimate prescribed for the given mix.

On caisson work it is possible to use a drier mix than for concrete in other locations and the tendency of the future will be toward concrete mixed scientifically.

In this connection, on one job where such an effort was made no definite proportions of materials were fixed but an ultimate strength at 28 days was specified and the water cement ratio fixed. The concrete poured was considerably drier than that usually used in similar work. Test samples were taken and the tests showed that greater strength was obtained with less cement than would have ordinarily been used.

Another case in which the usual mix by volume was used but the amount of water used was carefully checked and kept low, strengths were obtained on samples tested at 28 days that were 50% greater than the required. These test results were plotted in a relation to the amount of water used and show that the strength was an inverse proportion to the amount of water used.

Undoubtedly, one of the most interesting questions to all of us is the comparative cost between the three types of foundations. We all know that pile foundations generally cost more than spread foundations.

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and that piers to hardpan or rock cost more than piles, but how much more? Definite ratio cannot be fixed due to a number of things that influence the ratio one way or the other. Local conditions and market conditions have a great deal to do with such comparison. For instance, in one case where a wood pile design was changed at the last minute, after the contract was let and at the request of the Contractor, from piles to hardpan piers, there was very little additional cost. This additional cost was saved when consideration was given to the saving in time on this construction.

Following are comparative figures of costs for a single column footing, of several types for an assumed net column load of 355 tons. The top of the footing is assumed just below the basement floor which is at elevation plus 3'3".

Spread Footing at 3500 lbs. per sq. ft. soil pressure 15'0" x 15'0".....$1.78 per ton of supported load.

Pile footing—15 wood piles, 50' long, including reinforced concrete cap.....$2.41 per ton of supported load.

Pier to hard-pan at elevation minus 60', 4'0" in diameter of shaft belled to 9'6" diameter—pressure 12,000 lbs. per sq. ft. on hard-pan—1-2-4 concrete .....$4.35 per ton of supported load.

Pier to rock at elevation minus 95' — 4'0" diameter 1-2-4 concrete.....$4.62 per ton of supported load.

These costs do not include any amounts for shoring or for special construction, such as combined or cantilever foundations, but represent a typical interior column foundation under normal conditions. It is to be noted that line wall conditions requiring combined or cantilever foundations will increase the costs. We sometimes find conditions such that the costs of spread foundations are increased to the extent that it is cheaper to use piles and perhaps in an extreme case to go to piers to hard-pan or rock.

The costs for piers to hard-pan or rock do not cover pumping or costs for widening out and driving in bad soil. Such costs are extra amounts on contracts and vary considerably. An illustration of such an amount is a job on which there was an extra of $80,000.00 for 140 piers to rock at elevation minus 93'0" or $572.00 per pier.

The cost for 4'0" diameter piers is used above to illustrate the comparison in cost of the several types for the same load. Higher unit costs are found for the smaller piers than for those of larger diameters. As an illustration a 6'0" pier of 1-2-4 concrete to rock at elevation minus 95'0" and top at plus 2'6", figured on the same basis as for the 4'0" diameter pier gives a unit cost of $3.63 per ton of supported load. Similarly a 5' pier of 1-1-2 mix gives a unit cost of $2.85 per ton of supported load. In this connection it will be noted that the 5' pier of the richer mix has practically the same capacity as the 6' diameter pier of 1-2-4 concrete. The lower cost on the richer mix pier illustrates the point already mentioned of the economy of the richer mix concrete piers for the larger sizes.

In obtaining data based on actual cost in the field one cannot be sure that the cost for different jobs are on the same basis, as some of such costs may include costs for shoring and other similar items along with the actual foundation costs. Some data from costs on recent work which gives some idea of how these units run is given below:

On one job the cost of piers to rock ran $3.80 per ton, or 3½c per cu. ft. of building above the foundations. On this job no shoring is included and these unit represents the net cost of the caissons.

On another job the cost for piers to rock for a ton of supported load was $4.05 or 4.4c per cu. ft. of building above foundations.

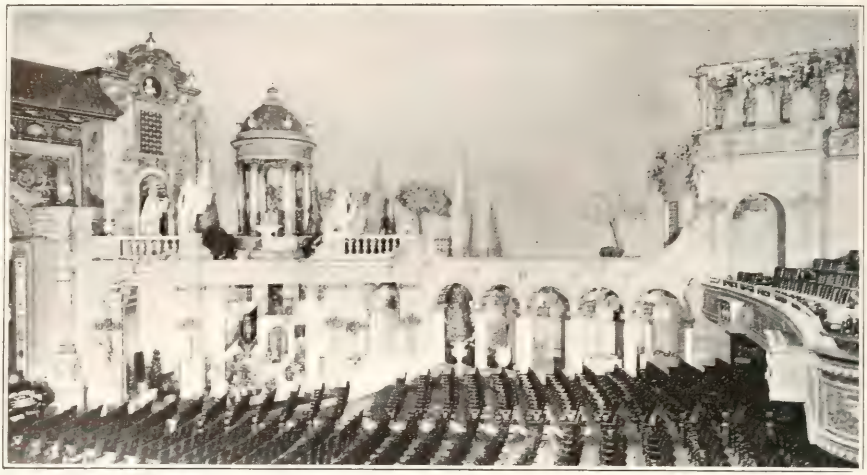
On still another job the unit cost for piers to rock was $7.00 per ton of supported load and 6.3c per cu. ft. This one undoubtedly includes shoring, of which there was considerable on this particular job, and also, it should be noted that the rock was at a depth of approximately 115' below datum.

On still another caisson job the unit cost was $5.43 per ton of supported load. This figure is on a job where the rock ran to about 115' below datum.

On a recent hardpan caisson job the unit cost was $4.42 per ton of supported load or about 5c per cu. ft.

On still another building on which figures were obtained for pile foundations the unit cost was $4.75 per ton of supported load or 5.4c per cu. ft. These units are based upon the Contractor's estimate. A change in the plan was made and the foundations used were piers, or caissons to hardpan. The cost of this work as executed gives a cost of $4.90 per ton of supported load or 5.7c per cu. ft.

For a recent wood pile job a unit cost of $3.00 per ton of supported load or 2.2c per cu. ft. was found.



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4′-0	723.8	868.6	1049.5	1809.56	12.57
4′-3	817.1	980.5	1184.8	2042.82	14.19
4′-6	916.1	1099.3	1328.3	2290.22	15.90
4′-9	1020.7	1224.8	1480.0	2551.71	17.72
5′-0	1131.0	1357.1	1639.9	2827.43	19.63
5′-3	1246.9	1496.3	1808.0	3117.25	21.65
5′-6	1368.4	1642.2	1984.3	3421.19	23.76
5′-9	1495.7	1794.9	2168.8	3739.28	25.97
6′-0	1628.6	1954.3	2361.5	4071.51	28.27
6′-3	1767.1	2120.6	2562.4	4417.86	30.68
6′-6	1911.3	2293.6	2771.4	4778.36	33.18
6′-9	2061.2	2473.4	2988.7	5153.00	35.78
7′-0	2216.7	2660.0	3214.2	5541.77	38.48
7′-3	2377.8	2853.4	3447.9	5944.68	41.28
7′-6	2544.7	3053.6	3689.8	6361.73	44.18
7′-9	2717.1	3260.6	3939.9	6792.91	47.17
8′-0	2895.3	3474.4	4198.2	7238.23	50.27
8′-3	3079.1	3694.9	4464.7	7697.69	54.54
8′-6	3288.5	3922.1	4739.3	8171.28	56.75
8′-9	3463.6	4156.3	5022.2	8659.01	60.13
9′-0	3664.4	4397.2	5313.3	9160.88	63.62
9′-3	3870.7	4644.9	5612.6	9676.89	67.20
9′-6	4082.8	4899.4	5920.0	10207.00	70.88
9′-9	4300.5	5160.6	6235.7	10751.3	74.66
10′-0	4523.9	5428.7	6559.6	11309.7	78.54
10′-3	4752.9	5703.5	6891.7	11882.3	82.52
10′-6	4987.6	5985.1	7232.0	12469.0	86.59
10′-9	5227.9	6273.5	7580.5	13069.8	90.76
11′-0	5473.9	6568.7	7937.2	13684.8	95.03
11′-3	5725.5	6870.7	8302.0	14313.9	99.40
11′-6	5982.8	7179.4	8675.1	14957.1	103.86
11′-9	6245.8	7494.9	9056.4	15614.5	108.43
12′-0	6514.4	7817.3	9445.9	16286.0	113.09
12′-3	6778.6	8146.4	9843.6	16971.7	117.86
12′-6	7068.6	8482.3	10249.5	17671.5	122.74
12′-9	7354.1	8824.9	10663.5	18385.4	127.68
13′-0	7645.4	9174.4	11085.8	19113.4	132.73
13′-3	7942.3	9530.7	11516.3	19855.7	137.89
13′-6	8245.0	9893.7	11954.9	20612.0	143.14
13′-9	8553.0	10263.6	12401.9	21382.5	148.49
14′-0	8866.8	10640.2	12856.9	22167.1	153.94
14′-3	9186.3	11023.6	13320.2	22965.8	159.48
14′-6	9511.5	11413.8	13791.6	23778.7	165.13

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- Web shear—Sec. 5 (d)
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1. This Specification defines the practice adopted by the American Institute of Steel Construction for the design, fabrication, and erection of structural steel for buildings.

2. General:

To obtain a satisfactory structure, the following major requirements must be fulfilled.

(a) The material used must be suitable, of uniform quality, and without defects affecting the strength or service of the structure.

(b) Proper loads and conditions must be assumed in the design.

(c) The unit stresses must be suitable for the material used.

(d) The workmanship must be good, so that defects or injuries are not produced in the manufacture.

(e) The computations and design must be properly made so that the unit stresses specified shall not be exceeded, and the structure and its details shall possess the requisite strength and rigidity.

3. Material:

Structural steel shall conform to the Standard Specifications of the American Society for Testing Materials for Structural Steel for Buildings, Serial Designation A 9-21, as amended to date

4. Loading:

(a) Steel structures shall be designed to sustain the dead weight imposed upon them, including the weight of the steel frame itself and, in addition, the maximum live load as specified in each particular case. Proper provision shall be made for temporary stresses caused by erection.

(b) In cases where live loads have the effect of producing impact or vibration, a proper percentage shall be added to the static live load stresses to provide for such influences, so that the total stress found in any member is an equivalent static stress.

(c) Proper provision shall be made for stresses caused by wind both during erection and after completion of the building. The wind pressure is dependent upon the conditions of exposure, but the allowable stresses specified in section five (5), paragraphs (f and (g), are based upon the steel frame being designed to carry a wind pressure of not less than twenty (20) pounds per square foot on the vertical projection of exposed surfaces during erection, and fifteen (15) pounds per square foot on the vertical projection of the finished structure.

(d) Proper provision shall be made to securely fasten the reaction points of all steel construction and transmit the stresses to the foundations of the structure.

5. Allowable Stresses:

All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per sq. in. shall not exceed the following:

(a) **Tension:** Rolled Steel, on net section 18,000

(b) **Compression:** Rolled Steel, on short lengths or where lateral deflection is prevented 18,000

On gross section of columns,

$$\frac{18{,}000}{1+\frac{l^2}{18{,}000r^2}}$$

with a maximum of 15,000

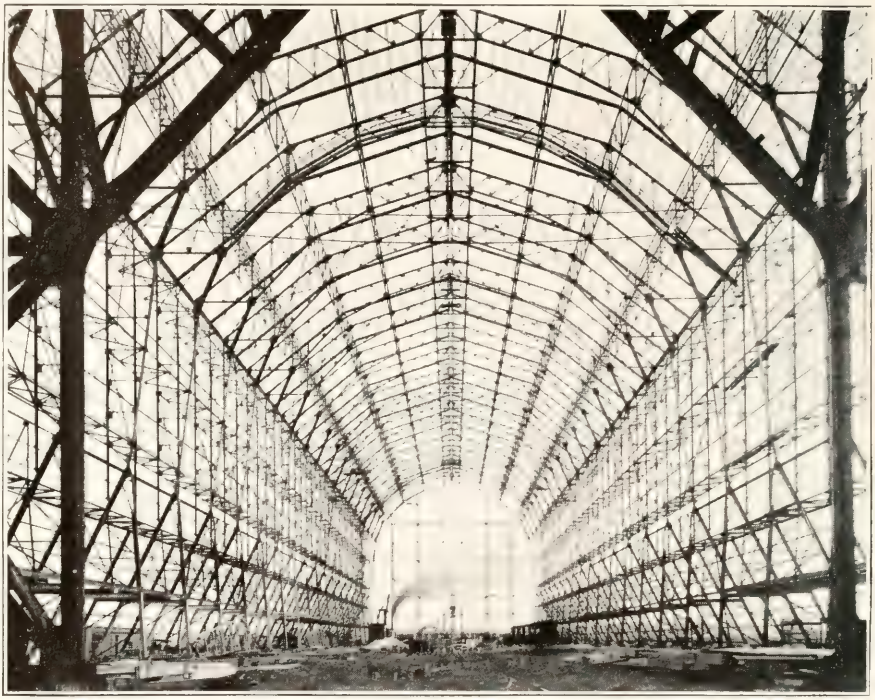
In which l is the unsupported length of the column, and r is the corresponding least radius of gyration of the section, both in inches.

For main compression members, the ratio l/r shall not exceed 120, and for bracing and other secondary members, 200.

(c) **Bending:** On extreme fibres of rolled shapes, and built up sections, net section, if lateral deflection is prevented 18,000

When the unsupported length l exceeds 15 times b, the width of the compression flange, the stress in pounds per sq. in. in the latter shall not exceed.

$$\frac{20{,}000}{1+\frac{l^2}{2{,}000b^2}}$$



U. S. GOVERNMENT AIRSHIP HANGAR — Scott Field, Ill.
Length 925 ft., width 298 ft., height 163 ft.

STROBEL STEEL CONSTRUCTION CO.

Contracting Engineers

For Fabricating and Erecting—Theatres—
Bridges—Steel Structural Work—
Buildings—Bascule Bridges—Turntables

1744-48 MONADNOCK BLOCK
CHICAGO

The laterally unsupported length of beams and girders shall not exceed 40 times b the width of the compression flange.

On extreme fibres of pins, when the forces are assumed as acting at the center of gravity of the pieces.. 27,000
(d) **Shearing:** On pins..... 13,500
On power-driven rivets..... 13,500
On turned bolts in reamed holes with a clearance of not more than 1/50 of an inch..... 13,500
On hand-driven rivets..... 10,000
On unfinished bolts..... 10,000
On the gross area of the webs of beams and girders, where h, the height between flanges in inches, is not more than 60 times t, the thickness of the web in inches..... 12,000
On the gross area of the webs of beams and girders if the web is not stiffened where h, the height between flanges in inches, is more than 60 times t, the thickness of the web, the maximum shear per square inch, S/A shall not exceed

$$\frac{18{,}000}{1+\frac{h^2}{7{,}200t^2}}$$

In which S is the total shear, and A is the gross area of web in square inches.

	Double Shear	Single Shear
(e) **Bearing:** On pins.....	30,000	24,000
On power-driven rivets.....	30,000	24,000
On turned bolts in reamed holes	30,000	24,000
On hand-driven rivets.....	20,000	16,000
On unfinished bolts.....	20,000	16,000

On expansion rollers per lineal inch 600 times the diameter of the roller in inches.

(f) **Combined Stresses:** For combined stresses due to wind and other loads, the permissible working stress may be increased 33⅓%, provided the section thus found is not less than that required by the dead and live loads alone.

(g) **Members Carrying Wind Only:**

For members carrying wind stresses only, the permissible working stresses may be increasod 33⅓%.

6. **Symmetrical Members:**

Sections shall preferably be symmetrical.

7. **Beams and Girders:**

(a) **Rolled beams** shall be proportioned by the moment of inertia of their net section. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in section five (5) as determined by the moment of inertia of the net section.

(b) **Plate girder webs** shall have a thickness of not less than 1-160 of the unsupported distance between the flanges.

(c) **Web splices** shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(d) **Stiffeners:** Stiffeners shall be required on the webs of rolled beams and plate girders at the ends and at points of concentrated loads, and at other points where h the clear distance between flanges is greater than $85t\sqrt{18{,}000}$ (A/S)-1, in which t is the thickness of the web. When stiffeners are required, the distance in inches between them shall not be greater than $85t\sqrt{18{,}000}$ (A/S)-1, or not greater than 6 feet. When h is greater than 60 times t, the thickness of the web of a plate girder, stiffeners shall be required at distances not greater than 6 feet apart. Stiffeners under or over concentrated loads shall be proportioned to distribute such loads into the web.

Plate girder stiffeners shall generally be in pairs, one on each side of the web, and shall have a close bearing against the flange angles at points of concentrated loading; stiffeners over the end bearings shall be on plate fillers The pitch of rivet in stiffeners shall not exceed 6".

(e) **Flange plates** of all girders shall be limited in width so as not to exceed more than 6" or more than 12 times the thickness of thinnest plate beyond the outer row of rivets connecting them to the angles.

(f) **Crane runway girders** and the supporting framework shall be proportioned to resist the greatest horizontal stresses caused by the operation of the cranes.

(g) **Rivets** connecting the flanges to the web at points of direct load on the flange betwen stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.

(h) **Rivets** connecting the flanges to the webs of plate girders and of columns subjected to bending shall be so spaced as to carry the increment of the flange stress between the rivets.

8. **Column Bases:**

(a) Proper provision shall be made to distribute the column loads on the footings and foundations.

(b) The top surface of all column bases shall be planed for the column bearing.

(c) Column bases shall be set true and level, with full bearing on the masonry, and be properly secured to the footings.

9. **Eccentric Loading:**

Full provision shall be made for stresses caused by eccentric loads.

10. **Combined Stresses:**

(a) Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

(b) All members and their connections which are subject to stresses of both tension and compression due to the action of live loads shall be designed to sustain stress giving the largest section, with 50% of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

11. **Abuting Joints:**

Compression members when faced for bearings shall be spliced sufficiently to hold the connecting members accurately in place. Other joints in riveted work, whether in tension or compression, shall be fully spliced

12. **Net Sections:**

(a) In calculating tension members, the net section shall be used, and in deducting the rivet holes they shall be taken ⅛ inch greater in diameter than the nominal diameter of the rivets.

(b) Pin connected tension members shall have the section through the pin hole 25% in excess of the net section of the member, and a net section back of the pin hole equal to 75% of that required through the pin hole.

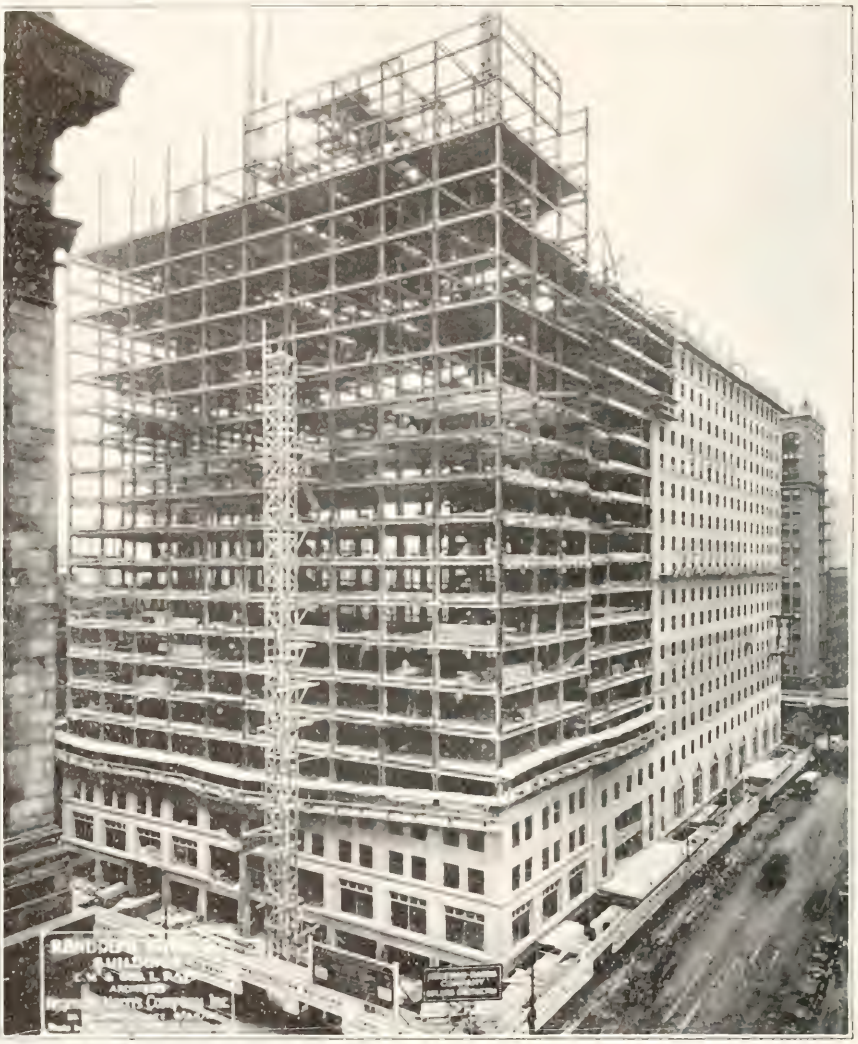
13. **Rivets and Bolts:**

(a) In proportioning rivets, the nominal diameter of the rivets shall be used.

(b) Rivets carrying calculated stresses and whose grip exceeds five diameters, shall have their number increased 1% for each additional $^1/_{10}$ inch in the rivet grip. Special care shall be used in heating and driving such rivets.

(c) Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

(d) Finished bolts in reamed holes may be used in shop or field work where it is impracticable to obtain satisfactory power-driven



7000 TONS

McCLINTIC-MARSHALL COMPANY

STEEL STRUCTURES

First National Bank Building

CHICAGO

rivets. The finished shank shall be long enough to provide full bearing, and washers used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all structures such as purlines, girts, door and window framing, alignment bracing and secondary beams in floor.

14. **Rivet Spacing:**

(a) The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than 4½ inches for 1¼ inch rivets, 4 inches for 1⅛ inch rivets, 3½ for 1 inch rivets, 3 inches for ⅞ inch rivets, 2½ for ¾ inch rivets, 2 inches for ⅝ inch rivets, and 1¾ inches for ½ inch rivets. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate or shape with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed 24 times the thinnest plate with a maximum of 18 inches.

(b) In tension members composed of two angles, a pitch of 3′-6″ will be allowed, and in compression members, 2′-0″, but the ratio l/r for each angle between rivets shall not be more than ¾ of that for the whole member.

(c) The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to 1½ times the maximum width of the member.

(d) The minimum distance from the center of any rivet hole to a sheared edge shall be 2¼ inches for 1¼ inch rivets, 2 inches for 1⅛ inch rivets, 1¾ inches for 1 inch rivets, 1½ inches for ⅞ inch rivets, 1¼ for ¾ inch rivets, 1⅛ for ⅝ inch rivets, and 1 inch for ½ inch rivets. The maximum distance from any edge shall be 12 times the thickness of the plate, but shall not exceed 6 inches.

15. **Connections:**

(a) Connections carrying calculated stresses except for lacing, sag bars, or angles, hand rails, or beam connections, shall not have less than 2 rivets; or for field connections not less than 3 rivets.

(b) Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

(c) The rivets at the ends of any member transmitting the stresses into that member should have their centers of gravity in the line of the center of gravity of the member; if not, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

(d) When a beam or girder "A" is connected to another member in such a manner that "A" acts as a continuous or fixed end beam, proper provision shall be made for the bending moments at such a connection.

(e) Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased; tight-fitting fillers shall be preferred.

16. **Lattice:**

(a) The open sides of compression members shall be provided with lattice having plates at each end and at intermediate points if the lattice is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones of not less than one-half of this distance. The thickness of tie plates shall not be less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the members, and the rivet pitch shall not be more than four diameters. Tie plates shall be sufficient in size and number to equalize the stress in the parts of the members.

(b) Lattice bars shall have neatly finished ends. The thickness of lattice bars shall be not less than one-fortieth for single lattice and one-sixtieth for double lattice of the distance between end rivets; their minimum width shall be as follows:

For 15″ channels, or built section with 3½″ and 4″ angles—2¼″ (¾″ rivets), or 2½″ (⅞″ rivets).

For 12″, 10″, and 9″ channels, or built sections with 3″ angles—2¼″ (¾″ rivets).

For 8″ and 7″ channels, or built sections with 2½″ angles—2″ (⅝″ rivets), or 2¼″ (¾″ rivets).

For 6″ and 5″ channels, or built sections with 1″ angles—1½″ (½″ rivets), or 1¾″ (⅝″ rivets).

(c) The inclination of lattice bars to the axis of the members shall generally be not less than 45°; but when the distance between the rivet lines in the flanges is more than 15 inches, the lattice shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

(d) Lattice bars shall be so spaced that the ratio l/r of the flange included between their connections shall be not over ¾ of that of the member as a whole.

17. **Expansion:**

Proper provision shall be made for expansion and contraction.

18. **Minimum Thickness:**

No steel less than $\frac{5}{16}$ inch thick shall be used for exterior construction, nor less than ¼ inch for interior construction, except for linings or fillers and rolled structural shapes.

These provisions do not apply to light structures such as skylights, marquees, fire-escapes, light one-story buildings or light miscellaneous steel work.

For trusses having end reactions of 35,000 pounds or over, the Gusset Plates shall be not less than ⅜ inch thick.

19. **Adjustable Members:**

The initial stress in adjustable members shall be assumed as not less than 5,000 lbs.

20. **Workmanship:**

(a) All workmanship shall be equal to the best practice in modern structural shops.

(b) Drifting to enlarge unfair holes shall not be permitted.

(c) The several pieces forming built sections shall be straight and fit close together: and finished members shall be free from twists, bends, or open joints.

(d) Rolled sections, except for minor details, shall not be heated.

(e) Wherever steel castings are used, they shall be properly annealed.

(f) **Punching:** Material may be punched $\frac{1}{16}$ inch larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus ⅛ inch. When the metal is thicker than the diameter of the rivet, plus ⅛ inch, the holes shall be drilled, or sub-punched and reamed.

(g) Rivets are to be driven hot, and wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform size throughout the work for the same size rivet, full, neatly finished, and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(h) Compression joints depending upon

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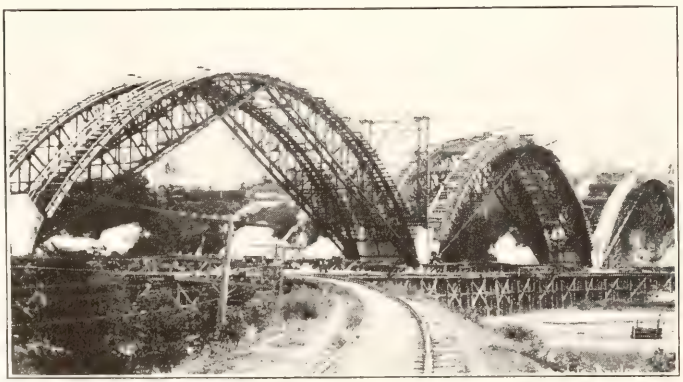


Mendota-Ft. Snelling Bridge

Koss Construction Co., Contrs.

contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight, especially where exposed to view.

(i) The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

21. **Painting:**

(a) Parts not in contact, but inaccessible after assembling shall be properly protected by paint.

(b) All steel work, except where encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well work into the joints and open spaces.

(c) Machine finished surfaces shall be protected against corrosion.

(d) Field painting is a phase of maintenance, but it is important that unless otherwise properly protected, all steel work shall after erection be protected by a field coat of good paint applied by a competent painter.

22. **Erection:**

(a) The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as may be required for safety.

(b) As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(c) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from the same.

(d) No riveting shall be done until the structure has been properly aligned.

(e) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

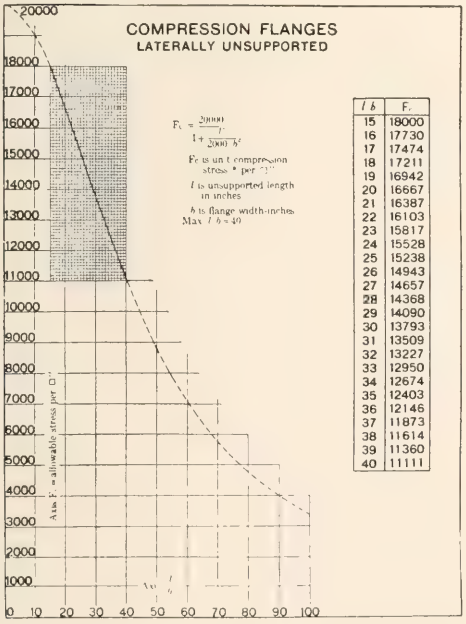
23. **Inspection:**

(a) Material and workmanship at all times shall be subject to the inspection of experienced engineers representing the purchaser.

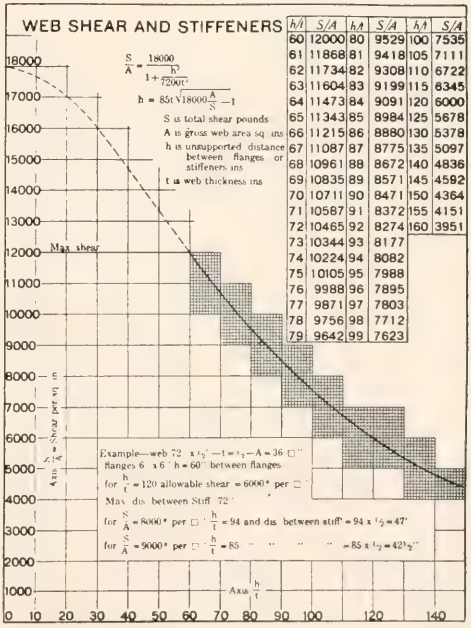
(b) Material or workmanship not conforming to the provisions of this Specification shall be rejected at any time defects are found during the progress of the work.

(c) The Contractor furnishing such material or doing such work shall promptly replace the same.

(d) All inspection as far as possible shall be made at the place of manufacture, and the Contractor or Manufacturer shall co-operate with the Inspector, permitting access for inspection to all places where work is being done.



l/b	F_c
15	18000
16	17730
17	17474
18	17211
19	16942
20	16667
21	16387
22	16103
23	15817
24	15528
25	15238
26	14943
27	14657
28	14368
29	14090
30	13793
31	13509
32	13227
33	12950
34	12674
35	12403
36	12146
37	11873
38	11614
39	11360
40	11111



h/t	S/A	h/t	S/A	h/t	S/A
60	12000	80	9529	100	7535
61	11868	81	9418	105	7111
62	11734	82	9308	110	6722
63	11604	83	9199	115	6345
64	11473	84	9091	120	6000
65	11343	85	8984	125	5678
66	11215	86	8880	130	5378
67	11087	87	8775	135	5097
68	10961	88	8672	140	4836
69	10835	89	8571	145	4592
70	10711	90	8471	150	4364
71	10587	91	8372	155	4151
72	10465	92	8274	160	3951
73	10344	93	8177		
74	10224	94	8082		
75	10105	95	7988		
76	9988	96	7895		
77	9871	97	7803		
78	9756	98	7712		
79	9642	99	7623		

(Continued on page 445)

Phones BRUNSWICK 7280-1-2-3

Ornamental and Miscellaneous Iron

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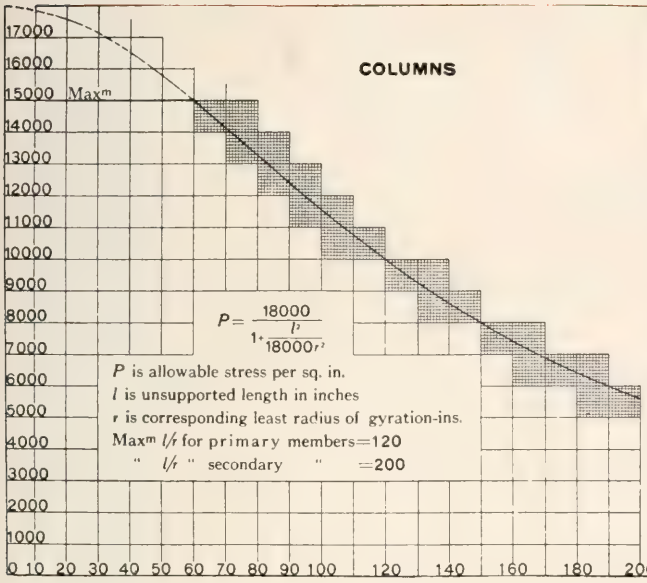

PRIMARY MEMBERS			
l/r	P	l/r	P
60	15000	90	12414
61	14916	91	12328
62	14832	92	12243
63	14748	93	12158
64	14661	94	12073
65	14578	95	11989
66	14492	96	11904
67	14407	97	11821
68	14321	98	11737
69	14235	99	11654
70	14150	100	11571
71	14062	101	11489
72	13975	102	11406
73	13888	103	11325
74	13801	104	11243
75	13714	105	11163
76	13627	106	11082
77	13540	107	11002
78	13452	108	10922
79	13366	109	10843
80	13279	110	10764
81	13192	111	10686
82	13104	112	10607
83	13018	113	10530
84	12931	114	10452
85	12844	115	10376
86	12757	116	10300
87	12672	117	10224
88	12585	118	10149
89	12500	119	10074
		120	10000

SECONDARY MEMBERS	
l/r	P
120	10000
125	9635
130	9283
135	8944
140	8617
145	8302
150	8000
155	7709
160	7431
165	7164
170	6908
175	6663
180	6429
185	6203
190	5989
195	5783
200	5586

TABLE OF COMPARATIVE STEEL PRICES

1900—1925

YEAR	PIG IRON No. 2 FOUNDRY Price per gross ton—delivered Chicago		BESSEMER BILLETS Price per gross ton—delivered Chicago		STEEL SKELETONS Price per net ton—delivered Chicago		40 STOCKS	
	High	Low	High	Low	High	Low	High	Low
1900	$23.85	$14.70	$38.00	$19.50				
1901	16.00	14.50	30.50	22.70		$45.60		
1902	23.35	16.00	35.50	30.50	$64.20	48.60		
1903	23.45	14.50	33.50	26.00	52.40	42.20		
1904	17.70	13.50	26.00	22.50	51.80	42.20	$ 85.00	$58.00
1905	19.60	16.50	29.00	25.00	58.70	54.00	100.00	79.00
1906	25.85	18.50	32.50	29.00	54.00	44.00	114.00	99.00
1907	26.85	18.40	33.30	31.00	56.60	53.60	111.00	67.00
1908	18.75	17.05	31.00	28.00	71.00	45.60	91.00	68.00
1909	19.30	16.70	30.50	26.00	54.80	40.00	106.00	88.00
1910	19.30	15.80	30.50	26.00	52.00	44.00	104.00	78.00
1911	15.80	14.30	26.00	22.20	44.00	39.40	95.00	82.00
1912	18.30	14.30	30.00	22.75	49.60	36.40	102.00	89.00
1913	18.50	14.20	31.50	23.00	61.20	46.60	94.00	77.00
1914	14.75	13.00	24.00	22.16	48.60	37.26	88.00	68.00
1915	19.00	13.30	34.16	22.16	59.00	34.10	102.00	72.00
1916	30.50	18.50	63.16	35.16	94.00	63.80	109.00	92.00
1917	55.50	30.50	103.16	50.66	105.00	95.00	102.00	68.00
1918	34.50	31.50	52.00	48.00	119.00	91.00	91.00	70.00
1919	40.50	27.25	52.40	43.00	110.00	79.00	100.00	80.00
1920	46.70	33.70	69.30	49.52	122.60	92.00	111.00	58.00
1921	32.70	18.95	49.52	35.02	83.60	48.00	78.00	65.00
1922	32.60	18.70	45.42	34.02	90.00	46.00	99.00	77.00
1923	32.60	23.10	50.42	40.92	120.00	71.00	98.00	82.00
1924	25.10	20.10	45.42	35.50	89.00	67.50	110.00	85.00
*1925	24.60	20.60	37.00	35.00	75.00	64.00	125.00	104.00

*To Oct. 20th.

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THE great advantage of having a permanent stairway for the use of workmen immediately following the structural iron or concrete workers is recognized by all, and the benefits derived from the use of our type of stairs are no longer a matter of speculation but an established fact. Aside from the many structural advantages, Woodbridge Standardized PRESTEEL Stairways cost considerably less than concrete and are so far superior in every respect that their universal adoption should be merely a matter of introduction.

Therefore we confidently declare that better construction at lower cost is absolutely certain when Woodbridge Standardized PRESTEEL Stairways are used.

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Catalogue 30

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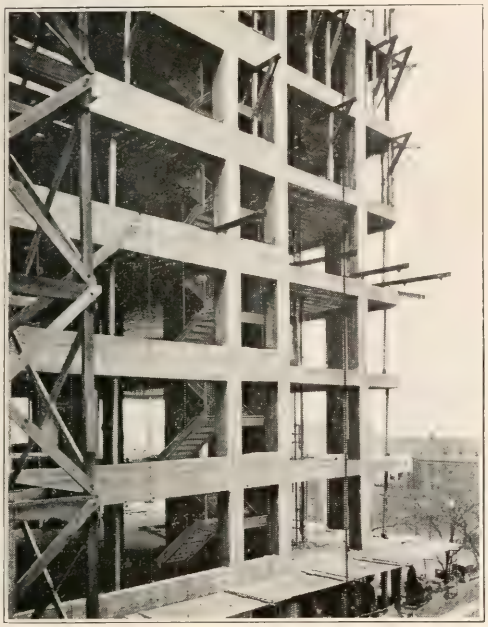
FIFTEEN-NINETEEN ALTGELD STREET

CHICAGO, ILL., U. S. A.

TELEPHONE DIVERSEY 5800 PRIVATE EXCHANGE ALL DEPARTMENTS

Woodbridge PRESTEEL Stairway



Complete Before a Brick Was Laid

Wellington-Arms Apartments
Chicago.

HOOPER & JANUSCH, *Engineers.*

THE advantage in using Woodbridge PRESTEEL Stairways in preference to concrete construction is readily appreciated when attention is directed to the illustration at the left. These stairs were completed and in use during the entire construction of the building after all concrete had been poured and even before many of the forms had been removed.

Men of all trades continually passed up and down immediately after our erectors had completed their work.

The illustration at the right is a closeup of one flight in the above building, another installation of our Design 6 stair.

Our method of construction is particularly adapted to this early installation as all our stairs rest on floor below and above and all intermediate platforms are supported by hangers from floor above.

Woodbridge Ornamental Iron Co.

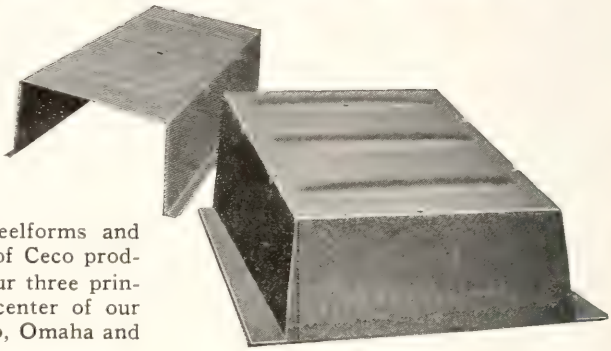
INCORPORATED

FIFTEEN-NINETEEN ALTGELD STREET

CHICAGO, ILLINOIS, U. S. A.

MEYER STEELFORMS

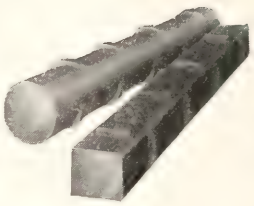
Meyer Removable Steelforms are one of the greatest achievements effecting the saving of concrete, steel, form work, time and labor in modern building and construction. For quicker delivery of Meyer Steelforms and fabrication and shipment of Ceco products, we have stationed our three principal warehouses in the center of our field of operation: Chicago, Omaha and Kansas City.



Ceco PRODUCTS

Ceco Reinforcing Bars are of the most efficient type, their bond resisting value being determined by the deformations or lugs being placed at right angles to the axis of the bar (Test reports furnished on request).

Ceco Reinforcing Bars are only one of the many Ceco quality products such as Column Spirals, Barchairs and Spacers, Woven and Welded Wire Mesh, Road Strips, Lathing Materials.



For more detailed information on Meyer's Steelforms and CECO Reinforcing and Fireproofing materials, send for our Handbook on Fireproof construction.

CONCRETE ENGINEERING CO.

1926 South 52nd Avenue, Chicago

Omaha, Detroit, Milwaukee, Des Moines, Dallas, Minneapolis, St. Louis, Kausas City, Houston.

STANDARD SPECIFICATIONS FOR BILLET-STEEL CONCRETE REINFORCEMENT BARS

Serial Designation: A 15—14.

The specifications for this material are issued under the fixed designation A 15; the final number indicates the year of original issue, or in the case of revision, the year of last revision.

Adopted, 1911; Revised, 1912, 1913, 1914.

(1) (a) These specifications cover three classes of billet-steel concrete reinforcement bars, namely: plain, deformed, and cold-twisted.

(b) Plain and deformed bars are of three grades, namely: structural-steel, intermediate and hard.

2. (a) The structural-steel grade shall be used unless otherwise specified.

(b) If desired, cold-twisted bars may be purchased on the basis of tests of the hot-rolled bars before twisting, in which case such tests shall govern and shall conform to the requirements specified for plain bars of structural-steel grade.

I. Manufacture.

3. (a) The steel may be made by the Bessemer or the open-hearth process.

(b) The bars shall be rolled from new billets. No rerolled material will be accepted.

4. Cold-twisted bars shall be twisted cold with one complete twist in a length not over 12 times the thickness of the bar.

II. Chemical Properties and Tests.

5. The steel shall conform to the following requirements as to chemical composition:

Phosphorus
Bessemer.......not over 0.10 per cent
Open-hearth.... " " 0.05 "

6. An analysis to determine the percentages of carbon, manganese, phosphorus and sulfur, shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 5.

7. Analysis may be made by the purchaser from finished bars representing each melt of open-hearth steel, and each melt, or lot of ten tons, of Bessemer steel, in which case an excess of 25 per cent above the requirements specified in Section 5 shall be allowed.

III. Physical Properties and Tests.

8. (a) The bars shall conform to the following requirements as to tensile properties:

Tensile Properties.

Properties Considered.	Plain Bars. Structural Steel Grade.	Plain Bars. Intermediate Grade.	Plain Bars. Hard Grade.	Deformed Bars. Structural Steel Grade.	Deformed Bars. Intermediate Grade.	Deformed Bars. Hard Grade.	Cold-twisted Bars.
Tensile strength, lb. per sq. in...	55,000 to 70,000	70,000 to 85,000	80,000 min.	55,000 to 70,000	70,000 to 85,000	80,000 min.	Recorded only.
Yield point, min., lb. per sq. in....	33,000	40,000	50,000	33,000	40,000	50,000	55,000
Elongation in 8 in. min., per cent..	1,400,000* / Tens. str.	1,300,000* / Tens. str.	1,200,000* / Tens. str.	1,250,000* / Tens. str.	1,125,000* / Tens. str.	1,000,000* / Tens. str.	5

(b) The yield point shall be determined by the drop of the beam of the testing machine.

9. (a) For plain and deformed bars over ¾ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each increase of ⅛ in. in thickness or diameter above ¾ in.

(b) For plain and deformed bars under 7/16 in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each decrease of 1/16 in. in thickness or diameter below 7/16 in.

10. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend-Test Requirements.

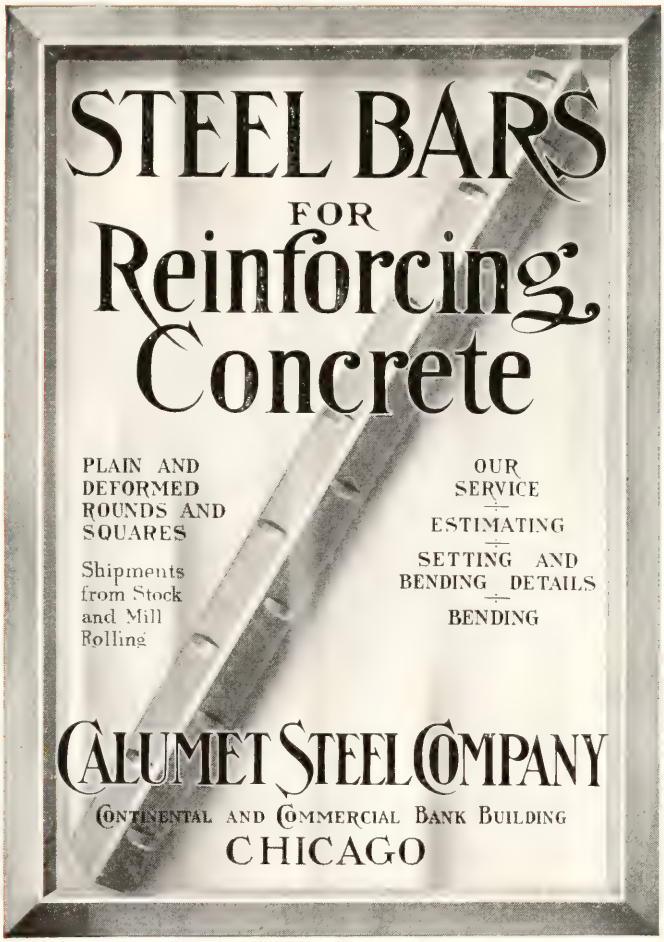
Thickness or Diameter of Bar.	Plain Bars. Structural-Steel Grade.	Plain Bars. Intermediate Grade.	Plain Bars. Hard Grade.	Deformed Bars. Structural-Steel Grade.	Deformed Bars. Intermediate Grade.	Deformed Bars. Hard Grade.	Cold-twisted Bars.
Under ¾ in....	180 deg. d=t	180 deg. d=2t	180 deg. d=3t	180 deg. d=t	180 deg. d=3t	180 deg. d=4t	180 deg. d=2t
¾ in. or over...	130 deg. d=t	90 deg. d=2t	90 deg. d=3t	90 deg. d=2t	90 deg. d=3t	90 deg. d=4t	180 deg. d=3t

Explanatory Note: d=the diameter of pin about which the specimen is bent; t=the thickness or diameter of the specimen.

11. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for cold-twisted bars shall be taken from the finished bars, without further treatment; except as specified in Section 2 (b).

12. (a) One tension and one bend test shall be made from each melt of open-hearth steel, and from each melt, or lot of ten tons, of Bessemer steel; except that if material from one melt differs ⅜ in. or more in thickness or diameter, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

*See Section 9.

Members

RAIL STEEL REAL STRENGTH

Rail Steel Products
Association

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 8 (a) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

IV. Permissible Variations in Weight.

13. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.

V. Finish.

14. The finished bars shall be free from injurious defects and shall have a workmanlike finish.

VI. Inspection and Rejection.

15. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

16. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 7 shall be reported within five working days from the receipt of samples.

(b) Bars which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

17. Samples tested in accordance with Section 7, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests. the manufacturer may make claim for a rehearing within that time.

STANDARD SPECIFICATIONS FOR RAIL STEEL CONCRETE REINFORCEMENT BARS

As Adopted by American Society for Testing Materials, Philadelphia, Pa., U. S. A., 1913.

Classes.

1. These specifications cover three classes of rail-steel concrete reinforcement bars, namely: plain, deformed, and hot-twisted.

I. MANUFACTURE.

Process.

2. The bars shall be rolled from standard section Tee rails.

Hot-twisted Bars.

3. Hot-twisted bars shall have one complete twist in a length not over 12 times the thickness of the bar.

II. PHYSICAL PROPERTIES AND TESTS.

4. (a) The bars shall conform to the following minimum requirements as to tensile properties:

Properties Considered.	Plain Bars.	Deformed and Hot-twisted bars.
Tensile strength, lb. per sq. in....	80,000	80,000
Yield point, lb. per sq. in...........	50,000	50,000
Elongation in 8 in., per cent*.......	1,200,000 Tens. str.	1,000,000 Tens. str.

* See Section 5.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation.

5. (a) For bars over ¾ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each increase of ⅛ in. in thickness or diameter above ¾ in.

(b) for bars under 7-16 in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each decrease of 1-16 in. in thickness or diameter below 7-16 in.

Bend Tests.

6. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend Test Requirements.

Thickness or Diameter of Bar.	Plain Bars.	Deformed and Hot-twisted bars.
Under ¾ in......	180 deg. d = 3 t	180 deg. d = 4 t
¾ in. or over.....	90 deg. d = 3 t	90 deg. d = 4 t

Explanatory Note: d = the diameter of pin about which the specimen is bent; t = the thickness or diameter of the specimen.

Test Specimens.

7. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled, except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for hot-twisted bars shall be taken from the finished bars, without further treatment.

Number of Tests.

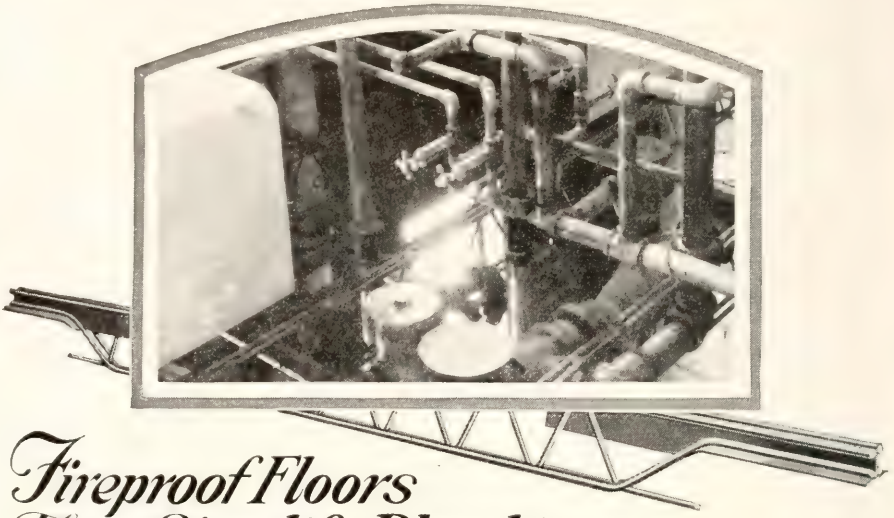
8. (a) One tension and one bend test shall be made from each lot of ten tons or less of each size of bar rolled from rails varying not more than 10 lb. per yd. in nominal weight.

(b) If any test specimen shows defective machining or develops flaws, or if a tension test specimen breaks outside the middle third of the gage length, it may be discarded and another specimen substituted.

III. PERMISSIBLE VARIATIONS IN WEIGHT.

Permissible Variations.

9. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.



Fireproof Floors That Simplify Plumbing

Efficient piping layouts are easily made where Massillon Bar Joist Fireproof Floor Construction is used. Pipes and conduits can be run in any direction. Large soil pipes may be installed along walls or supporting beams. Ample space is provided for carrying pipes over supporting members. Suspended ceilings and raised floor levels are in most cases eliminated.

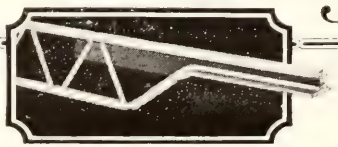
Massillon Bar Joists are made in eighteen standard sizes. They meet every requirement of span and load. Triangular and irregular shaped floors can be built without cutting joists. The joists are light in weight and easily handled. Write for complete information, safe loading tables and name of nearest distributor.

The Massillon Steel Joist Co., Canton, Ohio

Plants at Canton and Massillon, Ohio. Sales Offices in all principal cities

MASSILLON BAR JOISTS

PATENTS PENDING



Two Bars Top and Bottom

Solid Steel Welded Joints

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
CODE OF PRACTICE

PREFACE.

Since the use of structural steel came into existence about thirty-five years ago, there has developed an industry engaged in the fabrication and erection of this material which at the present time is annually furnishing over $300,000,000 worth of material to the public.

During this period of evolution it is obvious that many inconsistent practices should have come into existence, and the American Institute of Steel Construction, representing the industry between the rolling mills and the buying public, has undertaken the codifying of the various conditions, with a view of establishing uniform practice.

The Institute's Specification on the design, fabrication, and erection of structural steel has been received with widespread approval, and this Code of Standard Practice is now being issued to cover conditions not touched in the Specification.

Section 1. Design.

Unless otherwise specified or required, the design, fabrication and erection of structural steel shall conform to the Standard Specification of the American Institute of Steel Construction for buildings, dated June 1, 1923, or as amended to date.

Section 2. Classification.

(a) **General.**

The steel and iron items entering into the construction of a structure are divided into the following classes:

CLASS "A"—Structural Steel and Iron
CLASS "B"—Ornamental Steel and Iron
CLASS "C"—Steel Floor Joists
CLASS "D"—Miscellaneous Steel and Iron

In contracting to furnish the material for a structure where the material to be furnished is designated as structural steel and iron, ornamental steel and iron, steel floor joists, or miscellaneous steel and iron, the Seller will furnish only such items under each classification as are listed below, and no other items will be included unless by special understanding. In cases where materials in excess of minimum requirements are furnished to provide for waste or loss, all unused material remaining after completion of work shall be the property of the Seller and returned to him.

(b) **Class "A" Structural Steel and Iron.**

Contracts taken to furnish the structural steel and iron for a building are based on furnishing the following items only:

Anchors for structural steel only
Bases of steel or iron only
Beams of rolled structural steel
Bearing plates for structural steel
Brackets made of structural steel shapes
Channels of rolled structural steel
Channels and angle-supports only for suspended ceilings where they attach to structural steel but not including small channel or angle furring.
Columns, structural steel, cast iron and pipe
Girders of structural steel
Grillage, beams and girders (structural steel)
Hangers of structural steel
Lintels as shown or enumerated
Marquise (structural frame only)
Rivets and bolts for field connections, as follows:

1. The Seller shall furnish sufficient rivets of suitable size, plus at least 10% to cover waste for all field connections of steel to steel which are designated as riveted field connections.

2. The Seller shall furnish sufficient bolts of suitable size, plus 5% to cover waste for all field connections of steel to steel which are designated to be bolted unless specifically called for.

3. No fitting-up bolts or washers will be included.

Separators, angles, tees, clips, bracing and detail fittings in connection with structural steel frame.
Tie rods.
Trusses of structural steel.

Unless specifically agreed to in the contract, the Seller of the structural steel will not provide field connections or field holes for the ornamental steel and iron, the miscellaneous steel and iron, nor the materials for any other trades.

(c) **Class "B" Ornamental Steel and Iron.**

Contracts taken to furnish the ornamental steel and iron for a building are based on furnishing the following items only:

All Bronze and Brass work, except hardware fittings
Balconies
Cast Iron Cornices
Curtain Guides
Elevator fronts and enclosures
Grilles and gratings
Iron store fronts
Lamp standards and brackets
Marquise (steel or iron, except frame) see Class "A"
Ornamental brackets, steel or iron
Ornamental inside stairs, steel or iron
Ornamental outside steel or iron stairs, including fire escapes
Safety treads
Railings (gas pipes, ornamental or brass)
Sills and thresholds (brass, steel or iron)
Spiral stairs, steel or iron
Window sills and frames, steel or iron
Wire work, ornamental steel or iron

(d) **Class "C"—Steel Floor Joists.**

Contracts taken to furnish the steel floor joists for a building are based on furnishing the following items only:

Steel Joists which are not a part of the structural steel frame for the building, and which are devised to carry the floor or roof panels.
Bracing and bridging for floor joists; clips for fastening floor joists.
Stirrup and Hanger for Floor Joists.
Ties for floor joists.

(e) **Class "D" Miscellaneous Steel and Iron.**

The nature and character of the material of this classification makes it impossible to cover all items and it is recommended that the Seller taking the contract to furnish the miscellaneous steel and iron work for a building specify all items in detail which it is intended to furnish. The general list of items under this classification is as follows:

Area gratings
Cast iron cover and frames
Cast iron rainwater receivers
Cast iron downspout shoes
Cleanouts
Coal chutes
Column guards
Door frames and bucks
Foot scrapers
Furnace or fireplace dampers
Flag pole
Ladders
Pin rails
Sidewalk doors
Sills and curb angles, and anchors for same
Special bolts or anchors where distinctly shown on the plans
Stairs made of plain structural steel—not including treads of other materials
Stacks
Steel and cast iron platforms
Steel or iron chimney caps
Thimbles
Wall plate anchors

Harding Theatre — M. Fridstein, Engineer

GUARANTY IRON AND STEEL CO.

Ornamental Iron and Bronze

ELEVATOR DOORS AND ENCLOSURES

3847 to 3863 WEST LAKE STREET
CHICAGO

Telephones VAN buren 6016, 6017 and 6018

Wheel guards
Window guards
Wire screens for partitions, door and window guards (this does not include fly screens)

(f) **Materials Not Classed Under the Above Headings.**

The following items are not covered by classifications A, B, C, and D, and will in no case be furnished by the Seller unless specifically agreed to and mentioned in the contract. It is not possible to designate every detail, and the list is typical of material not included in classification A, B, C, and D. It is shown here to assist the Architect and Engineer in avoiding confusion:

Ash hoists
Awning boxes
Boilers
Elevators or accessories
Elevator guides or sheave beams
Expanded metal
Furring
Glass for any purpose whatever
Hollow metal doors or frames
Hoppers
Mail chutes
Metal lockers
Miscellaneous carpenter or masonry bolts for connecting wood to wood, steel to wood, or wood to stone, etc.
Name plates
Patented devices
Pilot and driving nuts
Reinforcing steel
Rolling doors
Sheet metal work or corrugated sidings and roofing
Sidewalk lights
Steel sash and steel sash partitions
Spiral slides
Suspended ceiling, except as noted under Class "A"
Tanks and pans
Toilet partitions
Treads, except steel or iron
Vault doors
Ventilating brick
Wall, ceiling and floor registers
Wood handrails
Wood handrail brackets
And all other material not mentioned.

Section 3. Invoicing.

When conditions make it possible to award contracts on a lump sum basis, the confusion of determining weights will be avoided. Scale weights involve a variation which frequently lead to a compromise based on calculated weights.

The rules hereafter established, while not giving exact weights, are the basis upon which the Seller must make a lump sum or a pound price bid, and they eliminate the necessity of increased cost of shop drawings and other refinements of manufacture which would very materially increase costs if exact weights were required.

(a) **Weights:** Structural steel and iron sold at a unit price per pound, hundred weight (100 lbs.) or ton (2,000 lbs.) shall be invoiced on the calculated weights of shapes, plates, bars, castings, rivets and bolts, based on the detailed shop drawings and shop bills as follows:

1. **Dimensions:** The weight will be figured on the basis of rectangular dimensions for all plates, and overall dimensions for all structural shapes, and with no deductions for copes, clips, sheared edges, punchings, borings, milling or planing. When plates can be economically cut in multiples out of one large rectangular plate, then the calculated weight of the plates shall be determined by the area of the large plate.

2. **Over-run.**

(a) To the nominal theoretical weights of all sheared plates will be added one-half the allowance for overrun in weights in accordance with the Specifications of the American Society for Testing Materials. (See tables in A. S. T. M. Specifications).

(b) Reinforcing bars when not sold on a basis of scale weights shall be invoiced by the Seller at the theoretical weight plus 1½% to allow for overrun weight of deformations, etc.

(c) To the theoretical weight of all castings shall be added 10% to cover average overrun.

3. **Rivets.**

(a) The weight of shop rivets will be based on the weights shown in the following table:

		Per 100 Rivets
1.	Rivets ½″ in diameter......	20 lbs.
2.	Rivets ⅝″ in diameter......	30 lbs.
3.	Rivets ¾″ in diameter......	50 lbs.
4.	Rivets ⅞″ in diameter......	100 lbs.
5.	Rivets 1 ″ in diameter......	150 lbs.
6.	Rivets 1⅛″ in diameter......	250 lbs.
7.	Rivets 1¼″ in diameter......	325 lbs.

(b) Field rivets and bolts shall be invoiced at their actual weight.

4. **Paint:** One-half of 1% of the theoretical weights of the material painted will be added for each coat of shop paint. For work oiled, one-fourth of 1% for each coat will be added.

Section 4. Drawings and Specifications.

(a) The Buyer shall furnish the Seller within a time agreed to in the contract a survey of the lot lines, together with a complete and full design of the structural steel frame definitely locating all openings, levels, etc., and showing all material to be furnished by the Seller with such information as may be necessary for the completion of the shop drawings by the Seller. All such information and drawings shall be consistent with the original drawings and specifications.

(b) In cases of discrepancies between the drawings and the specifications prepared by either the Seller or the Buyer, the specifications shall govern; and in case of discrepancies between the scaled dimensions on the drawings and the figures written on them, the figures shall govern. Should the Seller in the execution of his work find discrepancies in information furnished by the Buyer, he shall refer such discrepancies to the Buyer before proceeding further with work which would be affected.

(c) Shop Drawings shall be made and submitted to the representative of the Buyer, who shall examine the same and return them approved with such corrections as he finds necessary. They shall be corrected by the Seller if necessary and returned for the Buyer's file as finally approved. The Seller may proceed with shop work, but in so doing, he shall assume responsibility for having properly made the corrections indicated by the Buyer.

(d) Shop Drawings prepared by the Seller and approved by a representative of the Buyer shall be deemed the correct interpretation of the work to be done, but does not relieve the Seller of responsibility for the accuracy of details.

(e) After the plans and shop drawings have been "approved" or "approved as noted" by the authority designated in the contract, any further changes required shall be made at the expense of the Buyer.

(f) When detailed shop drawings are furnished by the Buyer no responsibility for misfits due to errors in the drawings will be assumed by the Seller.

Section 5. Good Workmanship and Standard Practice.

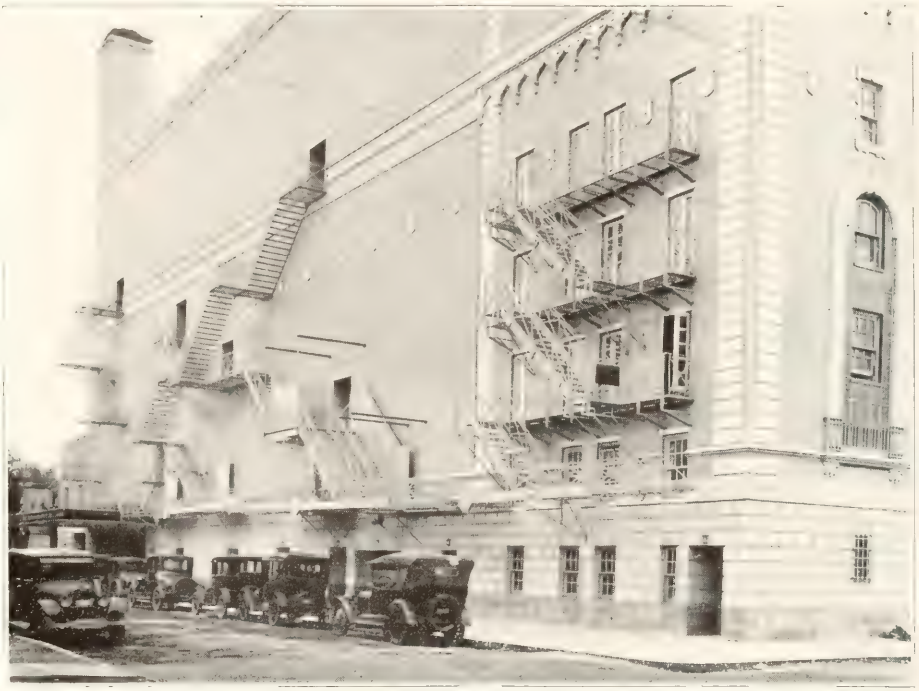
Good workmanship and standard practice in a modern structural shop is defined as follows:

(a) **Material:** Stock material shall be of a quality substantially equal to that called for by the specifications of the American Society for Testing Material for the classification covering its intended use; and mill test reports shall constitute sufficient record as to the quality of material carried

Chas. Johnson & Son

Fire Escape Co.

Established 1872



Uptown Theatre — C. W. & Geo. L. Rapp, Architects

Manufacturers of

STEEL FIRE ESCAPES

320-326 West Grand Avenue

CHICAGO

Phones: Superior 2085-2086

in stock. It is obviously impossible for the Seller to maintain records of heat or blow numbers of every piece of material in his stock, and the same shall not be required if all his stock purchases are made under an established specification as to grade and quality.

Whenever a shop maintains such a practice in carrying a stock of material, it is deemed good practice to permit the use of such stock material in its fabricating operations whenever the shop desires to do so, instead of ordering items from the mill for a specific operation. Stock materials bought under no particular specifications, or under specifications materially less rigid than those mentioned above, or stock material which has not been subject to mill or other recognized test reports, shall not be used, except as noted below, without the approval of the Buyer and under rigid inspection.

It is permitted to use unidentified stock material free from surface imperfections for short sections of minor importance or for small unimportant details, where the quality of the material could not affect the strength of the structure.

(b) **Straightening:** All material shall be straight, and if straightening or flattening is necessary, it shall be done by a process that will not injure the material. Sharp kinks or bends shall be cause for rejection.

(c) **Punching:** The punch shall be $\frac{1}{16}$" larger than the nominal diameter of the rivet, and the die opening not more than $\frac{1}{8}$" larger than the diameter of the punch. The thickness of the material in punched work shall not be greater than nominal diameter of the rivet, plus $\frac{1}{8}$". The accuracy of the punching shall be such that for any group of holes when assembled, 75% shall admit a rod equal to the diameter of the cold rivet at right angles to the plane of the connection, otherwise the holes shall be reamed.

Likewise, when work is assembled, all holes which will not admit a rod $\frac{1}{8}$" smaller than the nominal diameter of the cold rivet shall be reamed.

(d) **Reaming:** Reamed or drilled holes shall not be required unless specifically agreed to in the contract. When specifications require that work shall be sub-punched and reamed, the die used for punching shall be $\frac{1}{16}$" smaller than the nominal diameter of the rivet, and the assembled holes shall be reamed to a diameter of $\frac{1}{16}$" larger than the nominal diameter of the rivet.

(e) **Planing:** Planing or finishing of sheared plates or shapes will not be required unless specifically called for by the specifications or drawings.

(f) **Assembling:** All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting done during assembling shall not distort the metal to enlarge the hole on the side on which the die was used in punching.

Finished members shall be true to line and free from twists, bends and open joints. It is not the function of fitting up bolts to bring improperly straightened material into place, thus causing a strain on the rivets in the finished work.

Compression members shall not have a lateral variation greater than 1 to 1000 of the axial length between the points which are to be laterally supported.

An allowable variation of $\frac{1}{32}$" is permissible in the overall length of members with both ends milled.

Members without milled ends which are to be assembled to other steel parts of the structure shall not have an error greater than $\frac{1}{16}$" for members 30 feet or less in length, and not more than $\frac{1}{8}$" for members over 30 feet in length.

(g) **Riveting:** Rivets shall be heated uniformly to a light cherry red, and shall be driven and the heads formed with a proper sized die while hot. When heated and ready for driving, rivets shall be free from slage scale, and carbon deposits. When driven they shall completely fill the holes.

Loose, burned or otherwise defective rivets shall be replaced. After driving, the rivet heads, shall be full, neatly made, concentric with the rivet hole, and in full contact with the surface of the member. Caulking the rivet head shall not be permitted.

(h) **Burning Torch:** The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

The material adjacent to a burned surface for a distance equal to the thickness of the material shall not be considered a part of the net section for tension members.

Section 6. Inspection and Delivery.

(a) **Inspection:** The Seller's shop service includes inspection by his own inspectors, and shop or mill inspection other than this shall be paid for by the Buyer, except when otherwise called for in the specification.

(b) **Acceptance of Materials:** When material is inspected by a representative of the Buyer at the shop, the acceptance of such material by the Buyer's representative shall be considered the Buyer's final approval, but the Seller shall be responsible for the accuracy of the work and for defective material or workmanship which may be discovered before the completion of the structure.

(c) **Order of Delivery:** Unless the order or sequence of delivery is specifically arranged for before the work is undertaken, it will be at the convenience of the Seller.

(d) **Materials Sold Delivered.** When material is sold delivered on cars or trucks at the site of the structure, all unloading shall be done by the Buyer, and all responsibility to persons or property during such unloading shall be at the Buyer's risk.

(e) **Loss in Shipment where Material Is Sold Fabricated Only:** The quantity of material shown by the shipping statements will in all cases govern settlements unless notice of shortage is immediately reported to the agent of the delivering carrier, and his signed verification obtained, and like notice sent to the Seller within 48 hours after receipt of the shipment, in order that the alleged shortage may be investigated by the Seller.

(f) **Storage of Material:** Where conditions make it necessary that material be stored for any length of time, and the contract does not provide for such storage, payments are to come due and be payable the same as if the material had been delivered at the building site; and the Seller shall be compensated for handling storage, and other increased expenses as may result from such conditions.

Section 7. Erection.

(a) **Foundations:** The Seller or Erector shall not be responsible for the strength or suitability of the foundations.

(b) **Building Lines and Bench Marks:** Building Lines and Bench Marks at the site of the structure shall be accurately located by the Buyer, and carefully shown or described by him or his representative to the steel erector or his engineer.

(c) **Steel or Cast Iron Bases.** All steel grillage, slabs, or cast iron bases in bridge or building work shall be set to grade and line by the Buyer unless otherwise specifically agreed upon.

(d) **Anchor Bolts.** All anchor or foundation bolts shall be set by the Buyer.

(e) **Working Room:** The erection contractor shall be entitled to sufficient space at the site of the structure in a place convenient to him to place his derrick and other necessary erection equipment. When conditions at the site permit, he shall be entitled to storage space for enough material to keep his erection force in continuous operation.

(f) **Plumbing Up:** The temporary guys

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and braces shall be the property of the Seller, and if, after the steel has been plumbed and leveled, the work of completing the structure by other contractors is suspended or delayed, the owner of the temporary guys and braces shall receive reasonable compensation for their use. The guys shall be removed by the Buyer at his expense and returned to the Seller in as good condition as when placed in the building with a reasonable depreciation.

Immediately upon completion by the steel erector, the Buyer shall assure himself by whatever agencies he may elect, that the steel erector's work is plumb and level, and properly guyed. If it is not, he should immediately notify the erector and direct him to perfect his work. After the steel erector has guyed and plumbed the work once to the satisfaction of the Buyer, his responsibility ceases. Any further work in guying or plumbing shall be performed entirely at the Buyer's expense.

In the setting or erecting of structural steel work, the individual pieces shall be considered plumb or level where the error does not exceed 1 to 500.

For exterior columns and columns adjacent to elevator shafts of multiple story buildings, the error from plumb shall not exceed 1 to 1000 for the total height of the column.

(g) **Opportunity to Investigate Errors:** Correction of minor misfits and a reasonable amount of reaming and cutting of excess stock from rivets will be considered as a legitimate part of erection. Any error in shop work which prevents the proper assembling and fitting up of parts by the moderate use of drift pins, or a moderate amount of reaming and slight chipping or cutting, shall immediately be reported to the Seller and his approval of the method of correction obtained.

(h) **Wall Plates:** All loose masonry bearing plates for beams, lintels, trusses or columns shall be set to grade and line by the Buyer ready for the steel erector to set his work.

(i) **Loose Lintels:** Loose Lintels or pieces of all kinds and descriptions required by the design of a building to carry brick work over openings, and which lintels or pieces are not attached in any way to the rest of the steel structure, and cannot be placed except as the masonry work advances, will not be erected by the steel erector unless by special agreement.

(j) **Ornamental Iron and Bronze:** Fine ornamental iron and bronze work is considered as **finishing** material, and shall not be set in a building until after the marble, plaster, and other work, except decorating, is in place.

(k) **Elevator Framing:** The setting or erection of guides, cars, machinery, cables, sheaves, pans, etc., for elevators, is not to be required of the steel erector.

(l) **Field Assembling:** The size of assembled pieces of structural steel is fixed by the permissible weight and clearance dimensions of transportation.. Unless such conditions are provided for by the Buyer or his engineer, the Seller shall provide for such field connections as will require the least field work; and such field connections shall be a part of the erection work.

(m) **Cutting and Patching:** The Seller shall not be required to cut or patch any work, except his own, unless particularly specified, and will not alter his own work required by changes or inaccuracies in the building without being reimbursed for the expense of such changes.

(n) **Insurance:** The erector shall indemnify and save harmless the Buyer from all claims and costs arising from any damage to person or property occurring in the performance of his own work due to any act or neglect of his employees or agents.

(o) **Temporary Floors:** The Buyer shall provide plank, and cover all floors required by municipal or state laws, excepting the floor upon which the erecting derricks are located. This floor will be provided by the steel erector for working purposes.

(p) **Field Paint:** Unless specifically agreed to in the contract, field paint shall be considered a phase of maintenance, and such protection as is necessary shall be provided for by the Buyer.

Section 8. Delays in Prosecution of Work.

(a) **Causes Not Controlled by Seller nor Buyer:** Neither Seller nor Buyer shall be responsible for delays in performance caused by delays at rolling mills, or in transportation, or due to strikes, fires, floods, storms, or any other circumstances beyond their reasonable control, whether related or unrelated, or similar or dis-similar to any of the foregoing. In case of delay to work due to any of the above causes, a reasonable extension of time shall be given for the completion of the work.

(b) **Delays Caused by the Seller:** Should the Seller at any time, except as provided in the preceding paragraphs, refuse or neglect to supply enough workmen of proper skill or material of proper quality, or to carry on the work with promptness and diligence, the Buyer, if not at fault, may give the Seller ten days' written notice, and at the end of that time if the Seller continues to neglect the work, the Buyer may provide such labor or materials and deduct the cost from any money due or to become due the Seller under the contract, or may terminate the employment of the Seller under this agreement and take possession of the premises and of all materials, tools, and appliances thereon and employ any other person to finish the work. In the latter case, the Seller shall receive no further payment until the work be finished; then if the unpaid balance that would be due under the contract exceeds the cost to the Buyer of finishing the work, such excess shall be paid to the Seller but if such cost exceeds such unpaid balance, the Seller shall pay the excess to the Buyer.

(c) **Delays Caused by the Buyer:**. The Buyer shall be responsible for delays resulting from lack of complete data and from changes or revisions or the tardy approval of drawings. Information given later than the date fixed in the contract for the delivery of complete information shall not be cause for a claim by the Seller unless such delay affects Seller's costs or manufacturing operations. When such delays increase costs or compel changes in the Seller's manufacturing operations he shall be recompensed for the damage resulting.

If information is available for the Seller to manufacture or erect the material in accordance with the conditions of the contract and if he is prevented from the orderly and continuous prosecution of such work by any act or a neglect of the Buyer, the Seller may continue his work and may place fabricated material in storage at his own plant or elsewhere and the Buyer shall, upon tender of transfer of title, pay for said material as if it had been delivered under the terms of the contract. The Buyer shall also recompense the Seller for all expense incurred in the storing, caring for, or rehandling of said material; and for damage resulting from changed manufacturing operations. On erection work the Seller shall be recompensed for any extra expense incurred in wages and in the transportation of men or equipment to and from the site and their maintenance at the site during the period of delay, also for extra expense resulting from overtime made necessary by such delay.

If for more than one month at any time, any act or neglect of the Buyer or any legal proceeding taken against him, prevents the starting or continuous prosecution of the work, the Seller may give the Buyer ten days' written notice, and at the end of that time, if the Buyer continues at fault or the legal proceeding continues effective, the Seller may terminate his obligations under the contract; in which case the Buyer shall at

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once pay the Seller for the work done and material provided, and all damages the Seller may sustain, including damages resulting from changed shop operations.

Section 9. Extra Work.

(a) **General:** Charges for extra work, or work not covered by the contract, shall be made on a basis that is definitely and mutually understood between the Buyer and the Seller at the time the occasion for such extra expense arises.

In the absence of such an understanding between the Buyer and the Seller, the following is listed as proper expenses.

(b) **Material:** All extra material required shall be invoiced out at current warehouse prices, plus cost of fabrication, including regular overhead costs, plus transportation costs, and an agreed percent for profit.

(c) **Drafting Labor:** All extra labor in the drafting room shall be invoiced out at cost, plus overhead, plus an agreed percent for profit.

(d) **Shop Work:** All extra shop labor shall be charged at actual cost as shown by the time cards; to this shall be added the overhead expense, and the use of equipment and power. The sum of these charges shall be considered the actual cost of the shop, to which shall be added an agreed percent for profit.

(e) **Field Work:** All extra labor required in the erection of structural steel shall be invoiced as follows:

The actual labor cost shall be that shown by the time cards, to which shall be added the actual cost of insurance, the cost of labor transportation when necessary, and an additional allowance for overhead expense. The sum of these shall be considered the actual cost, to which shall be added an agreed percent for profit.

Should the Buyer or his agent or other trades engaged in the erection of other work connected with the structure require the use of materials or equipment belonging to the Seller, the Seller shall receive compensation for such extra service together with depreciation of equipment and an agreed per cent for profit.

(f) **Miscellaneous:** Any additional cost, such as hauling, painting, crating, freight, etc., shall be charged at actual cost, plus overhead, plus insurance, plus an agreed percent for profit.

(g) **Overtime:** On contract work where the Seller has not agreed to work overtime, he shall not be required to do so without being paid for his extra expense and a profit.

(h) **Extra Cleaning:** If because of continued storage, or for any other reason not the fault of the Seller, it should be necessary to clean and repaint the steel work, the cost of this additional cleaning and painting should be paid for as an extra, including regular overhead charges as specified for extra work elsewhere in this section.

Section 10. Proposals and Contracts.

(a) **Direct Contracts:** It is recommended that in all cases where the structural steel frame of a building is self supporting, and also in all such other cases where the structural steel and iron items entering into the construction of a building can easily be separated from the other materials of construction, that all contracts for such structural steel or iron be made separately by the owner or his representative with the steel contractor.

(b) **Conflicts:** In the event of a conflict between the terms and conditions of the proposal, and the terms and conditions stated in the plans and specifications, the terms of the proposal shall govern.

(c) **Price for Additions or Deductions:** The Seller is not to be required nor expected to make the same unit price for additions to as for deductions from the list of material required for a structure. The contract may, however, specify a certain other unit price for such materials as may be deducted from the quantity of material as orignally contemplated by the contract.

(d) **Material not Shown or Called for:** Clauses in the specification to the effect that all iron and steel items necessary to complete the structure shall be furnished by the Seller, whether or not they are shown on the plans or called for in the specifications, being obviously unfair, will not be recognized or subscribed to. The Seller shall, however, furnish all material and labor for details that may be required for such steel and iron work as is shown on the drawings or called for in the specification, although such details may themselves not be shown or called for.

(e) **Items not to be Furnished:** Unless specifically mentioned in the request for bids, or specifically agreed to, the bidders do not estimate or include the following items in their proposals:

Any charges for surety bonds or insurance not required by law, or any other general charge such as building permits, license fees or taxes for permission to work in city or state, engineering fees, removal of rubbish, patching or repairing of plaster or masonry work, office or telephone service, light heat, fire insurance, or the erection of temporary structures, enclosures, or stairs.

(f) **Terms:** The following terms of payment are adopted as standard and will govern in all cases, except when otherwise agreed to in the contract.

1. All payments shall be made in funds current at par in the city in which the Seller furnishing the material is located.

2. All materials for export, net cash in exchange for shipping documents will be required.

3. For all materials to be erected by the Seller the Buyer shall on the 10th day of each month pay an amount equal to not less than 90% of the contract value of all materials shipped, stored or ready for shipment; and not less than 90% of the contract value of the erection performed during the preceding month; and shall pay the remainder within 10 days after the completion of the steel contract; but the amount reserved by the Buyer shall at no time exceed double the contract value of the work remaining yet to be done.

4. When the material which is not to be erected by the Seller is sold to a Buyer whose credit has been established with the Seller, terms net cash for contract value of each shipment. Payments to be made on the 10th day of the month following shipments.

5. Unless otherwise agreed to when material is sold delivered at, or freight allowed to destination, the Buyer shall pay freight charges and the Seller shall accept receipted freight bills as cash to apply on matured payments due on or after arrival at destination of materials covered by such freight expense bills.

6. Payments shall all be considered to be due and shall be paid at the time specified, regardless of the final settlement for the building as a whole, or for the work of any other trade; and when the contract is with a general contractor the payment for steel shall not be delayed by such general contractor pending his receiving estimates of payments from the owner.

7. Amounts past due shall bear interest at the maximum lawful rate.

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FIELD CONTROL OF CONCRETE

By COL. H. C. BOYDEN, Dean of Engineering, Ohio Northern University, Ada, Ohio

The art of making concrete is centuries old and samples of the early product are in existence today still performing the duties for which they were made.

Concrete made with Portland cement, however, celebrated its one hundredth birthday last year and concrete made with American Portland cement is fifty-three years old.

Twenty-five years ago reinforced concrete was just beginning to attract widespread notice as a structural material, although a number of successful examples had been built years before.

The great advance made, as a result of the many investigations carried on during the last decade, has been along the lines of understanding the factors controlling uniform high quality concrete, and of the economies possible through the use of such knowledge.

From the brief outline of the progress in the art of making concrete the deduction must **not** be made that it is a new or an untried material, as the contrary is evidenced by the thousands upon thousands of concrete structures of many kinds that have stood for many decades without showing any signs of deterioration and are giving every evidence of lasting for centuries to come.

Concrete has been made for many years and is being made today, by following rules developed by experience alone that has given and will continue to give permanent service, but in this age of competition and scientific construction there are innumerable cases where it is not only desirable but often necessary to exercise the utmost economies and to use all of the potential strength in our construction materials.

In addition to the cases mentioned above good engineering demands the use of all materials in such a manner as to utilize their maximum efficiency in the structure so it may safely be said that advantage should be taken of the knowledge of fundamentals brought out by recent investigations, in the making of practically all concrete.

The importance of this is better understood when we consider that an estimated quantity of 110,000,000 cu. yd. of concrete was placed in 1923 and the saving of a small percentage of the cost or the addition of a small percentage to the strength must mean a very material sum of money.

It would be possible to show by detailed figures just what saving could be made in any hypothetical case but one example alone will illustrate the desired point. Let us assume a building or other structure requiring 10,000 cu. yd. of concrete to build. Everyone knows that concrete of a 7-inch slump is very commonly used and a concrete having a strength of 2,000 lb. per sq. in. at 28 days at that consistency would require about 15,500 bbl. of cement for the structure.

Experience and observation have shown that a slump of 4 inches is all that is required for the great bulk of concrete in structures and by simply cutting down the water to give this consistency in the concrete the same strength would be obtained with about 12,600 bbl. of cement for the structure. This would effect a saving of approximately 2,900 bbl. of cement.

In many cases a much wetter concrete with a slump greater than 7 inches is used and in such cases a larger saving may be effected in the same manner.

This is only one of the methods by which it is possible to effect economies in concrete construction and is cited simply to focus attention upon the value of scientific investigations, and the advisability at this time of making a study of the results of these investigations and then putting them into effect in construction.

It is not the intention to enter into a further discussion of the fundamental laws for making concrete, as they have been given widespread distribution and are available to all for the asking.

Assuming that the laws of design are understood and that the mixture has been decided upon, the next step is the control of operations in the field in order that the desired results may be obtained, and it is this phase that will be discussed.

Before entering upon this discussion however, it will be advisable to outline a number of basic factors that must be kept in mind throughout in order that the necessity for the various operations will be realized.

The factors it is wished to emphasize are:

1. Uniform aggregate
2. Water-cement ratio
3. Consistency
4. Curing

Although these four factors are not the only ones that affect the quality of concrete they are the ones having the greatest effect and will be the only ones discussed at this time.

The necessity for uniform aggregate, both fine and coarse, is being recognized more and more all over the country but there is room for improvement in many cases. Aggregate plants are being erected along up to date lines and an endeavor is made to turn out clean, well graded uniform aggregate, particularly when such a product is insisted upon by engineers and contractors.

It is obvious, that, when a mixture is based upon an aggregate of a certain fineness modulus, if that factor changes with every shipment, it will be impossible to obtain uniform results in the concrete. Although the fineness modulus is not the only measure of grading it is an index of the amount of water that will be required with a fixed amount of cement to produce a desired plasticity, therefore, it may still be used as a criterion of the grading of the aggregate.

One of the greatest difficulties encountered by the aggregate dealers in some sections of the country is the excess of certain sizes, which they are obliged to waste, due to the standard specifications for aggregates in use in those localities. Naturally this increases the cost of materials and it is a problem worthy of study and investigation in order that this waste be eliminated, or at least reduced to a minimum. Co-operation between the engineers and material dealers will often result in decided economies and a much more uniform product.

One fault that is common with many aggregate plants is the separation of the pit run material into too few sizes which is often productive of lack of uniformity. Some modern plants, however, are separating into more than the usual number of sizes—in one plant as high as seven.

This enables the dealer to deliver material of any desired mixture and fineness modulus within reason and it is hoped this practice will increase.

Care must be taken, however, in the loading, transportation, unloading and storing,

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in order to avoid resegregation into the various sizes, and the aggregate must go into the mixer for each batch uniformly graded. It is obvious that unless these precautions are taken, the resulting concrete will vary in quality.

The effect of the quantity of water used with a fixed quantity of cement as a factor of the strength is a generally accepted fact today and nothing has occurred in the last few years to upset this theory.

The ratio of mixing water to cement is **the most important** factor governing the quality of concrete and every effort must be made to keep this ratio uniform and all factors controlling this ratio during construction must be reckoned with.

In the minds of most constructors the idea is well fixed that cement is the most important ingredient of concrete and as a consequence the greatest care is taken in measuring it and less care is used with the other ingredients. When it is realized, however, that the addition of each pint of water above the proper amount has the same harmful effect as would leaving out a quart of cement, it will be seen that water is a more important ingredient that the cement and consequently should be measured with more care.

In view of the above facts, it will be readily seen that it is not only essential to carefully measure the water put into the mixer for each batch, but the amount of water contained in the aggregate, particularly in the sand, must be determined and taken into account. The water contained in the aggregate is a variable quantity, due to a number of conditions, but, as will be seen later, it may be a very considerable percentage of the total water in a batch of concrete and therefore will have a very decided effect upon the strength and other qualities of the concrete.

The importance of predetermining and of controlling the consistency of the concrete when it is being placed has been stressed upon for a number of years and much progress has been made towards its general adoption. It is desired, however, to again emphasize this factor in the control of the quality of concrete and to urge upon all concerned the necessity for strict control in all work.

Accepting the importance of the amount of water, in its relation to the volume of cement, and its effect upon the strength of concrete, it is very obvious that lax or no control of the consistency must mean a varying water-cement ratio with its consequent non-uniform concrete quality.

Inasmuch as water is the ingredient most commonly added to increase the workability of concrete, more harm is done by this practice than by any other operation in the making of concrete.

There is no simpler method of increasing all of the desirable qualities of concrete than that of fixing upon the stiffest consistency possible to use on a particular piece of work and keeping the water content down to just enough to give that consistency **and no more.** The following of this practice, together with the practice of reducing the cement in corresponding ratio to maintain the desired strength and no more, resulted on one large piece of construction in the saving of many thousands of barrels of cement and, incidentally, many thousands of dollars.

One of the most effective methods a contractor can adopt of insuring his work against failure is to cut down the mixing water whenever possible and thereby obtain concrete much stronger than he is expected to deliver. This is the cheapest form of insurance known, as it will cost him nothing and may actually save him money in operation.

In this connection, attention is called to the fact that, because one portion of a structure, such as a number of slender columns or a heavily reinforced girder, require considerable flowability in the concrete for proper and economical placing, there is no reason nor excuse for using the same plasticity in other portions of the structure, where the concrete can be used in a less plastic condition.

The idea that a stiffer consistency means a stiff, harsh working concrete, requiring ramming in place, is erroneous and attention is called to the remarks previously made, that "a slump of 4 inches is all that is required for the great bulk of concrete in structures." A concrete of this consistency will flow down a 1:2½ chute, will work readily around reinforcement and will not segregate in handling, but it is a much stiffer concrete than is only too often seen on construction.

The methods of control of the consistency in the field are none of them perfect, but until more convenient and effective ones are developed we must use them as best we can. The slump test, which is familiar to most engineers, is the most simple and convenient test yet devised, and, when carefully made, will give a control that will produce results within ten per cent of figured strengths. The flow table is more accurate than the slump test, but is not so mobile and is only suitable for work where considerable masses of concrete are being produced from a fixed position of the mixer.

The simplest (but not the best) method is the one used on a great dam now under construction, where solemn warning was given that the inspector would be discharged if it was found that a man in rubber boots would sink more than ten inches into the freshly deposited concrete. Note that no reference is made regarding the size of foot nor the weight of the man. The rules on the job require that a man shall sink in not less than two nor more than ten inches.

Absurd as this may appear on the face of it, nevertheless it is really a great advance over the methods in use at the beginning of the work, and, entirely due to the fact that the engineers have been awakened to the value of controlling the consistency, even by such a crude method as that described above, the strength of the concrete has been doubled, as is shown by compression tests.

The one essential point to remember is that, if additional flowability is required for some portion of a structure above that required for the bulk of the work, this flowability can be obtained and a uniform strength maintained only by adding water **and cement** in such quantities as will maintain the same water-cement ratio.

The effect of proper curing, that is, keeping the concrete **wet** for 21 days after placing has been emphasized so much during recent years that it should not be necessary to again describe the benefits derived. During the last few years, however, experiments carried on in several places have shown an additional benefit as a result of curing, that is fully as valuable as the benefits previously announced.

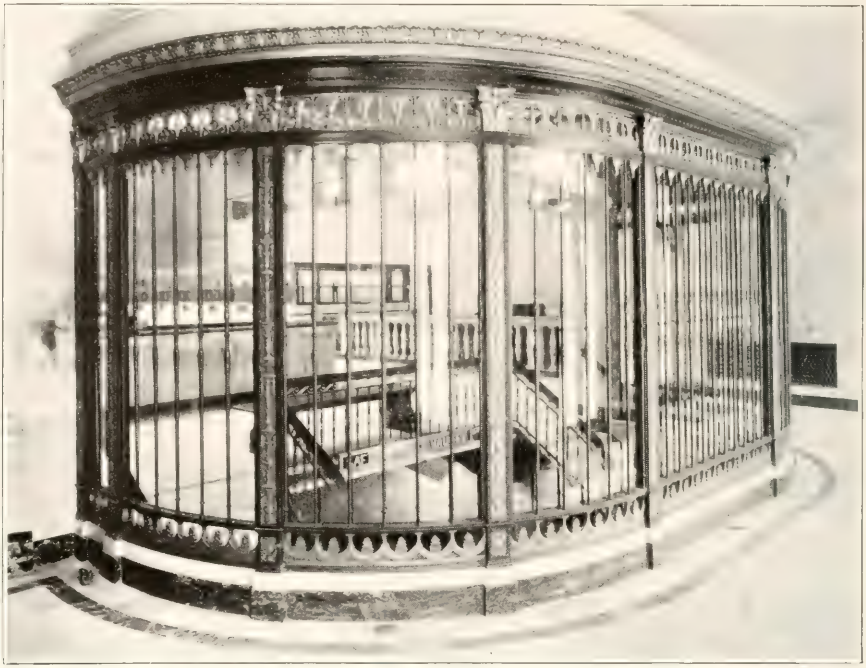
Bulletin No. 1245 of the University of Wisconsin describes "Permeability Tests on Broken Stone Concrete" and the following quotations from the conclusions are intensely interesting:

"Other factors remaining constant, the water-tightness of concrete made with well-graded aggregate increases with the proportion of cement in the mix."

"Maximum water-tightness obtains for a limited range of the water-cement ratio w/c. For the rich mixes this range is much wider than for lean mixes."

..."the use of excessive amounts of water, ... greatly increases the permeability of lean mixes."

"When conditions of placement require the use of a more fluid mix..., increased fluidity may be obtained, **without sacrifice of impervioussness,** by raising both the cement and water contents in the same proportion."



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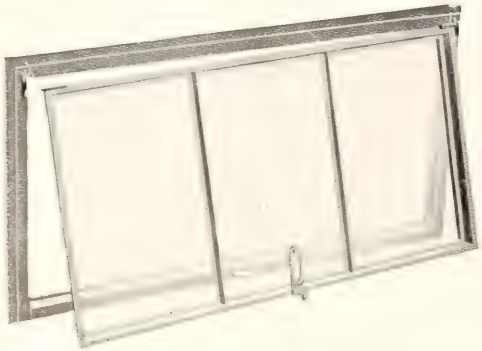

This illustration shows the "Ideal" window with the left end lug off the socket while the right end lug is in place—it shows the simplicity of removing the window—the lugs simply rest on two sockets—then the window swings into place and locks with a powerful but easy-to-operate cam arrangement. No hinges. No bolts. The steel frame is so constructed that it has a positive protection against weather.

These show the effect of cement content and water-cement ratio upon imperviousness, now note the effect of curing.

"To secure a high degree of imperviousness, concrete should be cured in a moist atmosphere or under water". "Lean mixes or thin sections require longer wet-curing periods than rich mixes or thick sections". "The effect of dry curing appears to be much more detrimental to water-tightness than to compressive strength."

"For making watertight concrete, well-graded gravel of good quality is superior to broken stone of like quality and grading."

Inasmuch as the difference between wet and dry curing has been proved to be over 100 per cent with regard to compressive strength, the value of wet curing to secure watertightness is beyond dispute.

The Engineering News-Record of June 19, 1924, gives an outline of tests carried on by the engineer of tests of Seattle, Wash., and a brief quotation is illuminating in this connection:

"(1) The slab cured in air showed moisture through the concrete under a pressure of 50 lb. per square inch in 7 minutes and a subsequent flow of 38 c.c. of water per hour. (2) The slabs cured by sprinkling showed moisture through the concrete under a pressure of 50 lb. per square inch in 53 minutes and developed a flow of 4 c.c. of water per hour. (3) The slabs cured in damp sand showed **no** moisture through the concrete after being subjected to 100 lb. pressure per square inch for 24 hours, which is equivalent to a head of 232 ft. of water.

The more the results of tests and investigations of concrete are studied, the more emphasis is placed upon the fact that water is the best friend and the worst enemy of concrete, depending upon when and how it is used, and three general rules may be deduced from such studies:

1. Use as **small an amount** of water in mixing concrete as will produce the minimum fluidity necessary for the work at hand.

2. Use as **much water** as possible in curing the concrete during its early hardening period.

3. Keep **all water out** of the concrete during its life, by making the concrete impervious

Obey these rules and the quality and life of all concrete will be multiplied many times.

The degree of care with which field control of concrete is carried out is generally dependent upon conditions existing upon each piece of work, and the results obtained will depend upon the degree of care. It is possible to greatly increase the value of the concrete on almost any job, no matter at what stage the work is, by following a few simple rules and it is also possible to effect still greater gains by the adoption of several methods.

In order to have available methods of control that may be adapted to any conditions that may exist, from the job already under contract with a fixed proportion and concreting actually underway, to the job yet in the planning state, with specifications and contract yet to be drawn up, leaving a clear track for the adoption of any desired method, four different methods will be outlined emphasizing different degrees of control.

The first method of control has to do simply with reducing the amount of water commonly used on the average concreting job and so controlling the output of the mixer as to keep the water content at the desired point. No attempt is made to enter into the field of scientific design of the mixture nor to correct errors in measurement of materials, as these factors will be considered in subsequent methods.

This method is based upon the assumption that the contract is let and the work already underway and that there is simply a desire on the part of the engineer or architect and the contractor to obtain the best quality of concrete possible under the existing conditions.

On Sheet No. 1 is an outline of the slump test, which is self-explanatory, and also an outline showing the recommended slumps for various types of concrete work. These recommended consistencies have been checked up by observation and tests on actual construction during the last two years and they can be used without increasing the cost of placing the concrete. Adoption of these consistencies will go far towards improving the general quality of concrete and it is through such simple methods that the greatest advances in field control must come.

Attention is called to the two curves on the chart showing the relation between the water-cement ratio (w/c) and the compressive strengths of concrete. Note that one curve (the upper one) has the equation of $\frac{14000}{7x}$ and the other curve (the lower) $\frac{14000}{9x}$

If we solve these two equations with w/c = 1.0 we find 2000 lb. for the upper and 1555 lb. for the lower, a difference of 445 lb. or 28% of the lower figure. This difference holds through practically the entire curve.

Early publications of the Structural Materials Research Laboratory show the upper curve, which indicates the average strength to be expected in concrete design but later publications show the lower curve which is the minimum strength curve. Bulletin No. 9 of this Laboratory is based upon the lower curve and this fact explains why tests of field concrete almost invariably show higher strengths than those indicated in the bulletin. Some comment has been made on this fact and the above explanation is given to clear up the misunderstanding.

The second method has to do with correcting the errors that occur when proportioning concrete by volumes, due to the bulking effect of moisture upon sand and also due to the losses in concrete strengths caused by the moisture in the sand. This method is applicable on all work, whether it is included in the specifications or whether the work is actually underway and it is most important that these corrections should be made.

The basis of this method is the fact that all concrete mixtures, whether designed for a certain strength or the more common empirical mixtures, are based upon the measurement **dry** and **rodded** of both the sand and stone or pebbles.

Both fine and coarse aggregates, when measured dry and rodded will weigh more per cu. ft. than will the same materials measured loose and either wet or dry. Also a cu. ft. of the aggregates measured **dry** and **rodded** will contain a larger number of particles than when measured under the usual field conditions.

These facts are due to the bulking effect of moisture, upon the materials, particularly upon sands, and to the practice, of loose measurement under field conditions, and this effect may cause a loss in the number of particles ranging from ten to forty per cent. In addition to these losses, which affect the yield of the concrete, the water contained in the aggregate is often a considerable factor in reducing the strength due to increasing the water-cement ratio.

These matters are very important and corrections should be made on every concrete job in order to insure the proper number of particles of aggregate, the proper yield of concrete per barrel of cement and the proper water-cement ratio.

On Sheet No. 2 are given two examples of the calculations required to make the corrections on a job where the proportions are already established as 1:2:4 and a minimum strength of 2000 lb. per sq. in. at 28 days is desired.

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The proper method of measuring aggregates, as prescribed by the American Society for Testing Materials, is outlined and these methods should be carefully followed. On the average job for a 4 sack batch, 8 cu. ft. of sand, measured loose and without regards to the moisture condition, and 16 cu. ft. of stone or pebbles, also measured loose, would be used, and there would probably be no measurement of the water except by the eye of the mixer operator.

In example No. 1, where it is assumed that the sand contains 4% (by weight) of water, the effect will be seen when it is found necessary to use 9.93 cu. ft. of loose, moist sand instead of 8.00 cu. ft. and instead of putting in a constant 27.00 gallon of water for a w/c of 0.9 only 23.6 gal. is required.

In these examples, for the sake of brevity, no correction is made for the coarse aggregate, but this correction can be made in the same manner. The essential thing, however, is to make the corrections for the sand, as the failure to do so is often the cause of undersanded concrete, requiring more water to obtain necessary fluidity, thereby resulting in weaker concrete and decreased yield per barrel of cement.

The **third method** embodies the calculations required for proportioning by weight and is a distinct step in advance of the use of volumes for proportioning. Based upon the same general principles, the calculations required are no more complicated than are those required in other methods and the results obtained are much better and more uniform than when volumetric methods are used.

The only objections to this method are that new calculations are required when the moisture content of the sand varies appreciably and also that standard equipment is not as yet available. This latter objection will be removed as the scale manufacturers realize the possibilities of this new market for their product and design such equipment. The Iowa state highway work is all carried on by this method and special installations of equipment have been placed in that state and elsewhere.

This method is very adaptable to cement product plants where the moisture content of the aggregate often varies considerably, depending upon the storage facilities and proportioning by weight will enable the plant to turn out a more uniform product.

There is one fault that may be found with the last two methods that keeps them from being the perfect method of control sought for. This is the necessity of making new calculations whenever the moisture conditions of the sand change to an appreciable extent. On some work the need of new determinations of the moisture content with the subsequent calculations will occur but seldom, but on other jobs the need will occur many times daily. In spite of this, the value gained in the concrete far more than offsets this work and well warrants the time and trouble.

The ideal method of control is one in which the calculations once made, all variations in the moisture conditions are automatically taken care of, so long as the grading of the aggregates remains the same. **The fourth method,** Proportioning by Inundation of the Sand, more nearly approaches the ideal than does any other method devised to date.

A series of experiments carried on at the Bureau of Standards has shown that the most accurate method found for the measurement of sands is to **shovel** or **pour sand into water.** If a number of vessels or containers are partly filled with water (to any point more than half full) and sands of the same grading, ranging from bone dry to saturated, are poured into the vessels until level with the top, each vessel will be found to contain the same number of grains of sand and the same number of pounds of water, regardless of the original water content of the sands.

It can be seen from this that if a proper apparatus can be devised for field use, the problem of automatic control of the water-cement ratio and the number of particles of sand has been solved. An apparatus for this purpose has been devised and is now on the market and this method is being used in many places.

The apparatus consists simply of a barrel-shaped container that is adjustable in size together with a second smaller container, either built as a compartment of the larger container or as a separate unit.

The first or large container is for measuring the sand and it is not necessary to measure the water put in just so long as there is enough to inundate the sand and allow a small excess to overflow.

The small container holds the water required in excess of the amount needed to inundate the sand to give the figured water cement ratio in the batch.

Only the sand is measured in this manner, the stone being measured either by volume or by weight with proper allowances for loose measurement and for water content, if any.

No water is put into the mixer except that contained in the two compartments of the container.

The number of large construction jobs where the "Inundators" have been installed and where concrete of exceptional uniform high quality has been the result is constantly increasing.

The use of this method is not believed to be possible with stiff mixtures, richer than 1:2:3, as the total water required may be less than that required to inundate the sand. Other cases of a similar nature may occur, but it is believed they will be very few and this method can be used on the great bulk of concrete construction.

In outlining these methods of field control no attempt has been made to describe methods of design of mixtures, as these methods have been the subject of previous discussions, but attention has been called to the need of uniformity in the aggregates. It is obvious that if the aggregates vary in grading from batch to batch or from day to day, it will greatly hamper the control of the quality of the concrete and will make numerous calculations and determinations necessary.

Experience and observation has shown, however, that where reasonable care is taken to control the aggregate supply, the work required to obtain accurate field control and to make such specimens as are required for testing can be done by one man, or two men when the work is very extensive. It has been stated by engineers who have used these methods of field control on extensive concrete construction that the inspection is no more costly than would be required under old methods.

Much progress has been made in the last two years towards the improvement of the quality of concrete, many large structures have and are being built under rigid control, studies and investigations have been carried on under actual field conditions through the co-operation of both scientific and contractors organizations, but there is much to be done before we can reach the goal of 100 per cent concrete everywhere.

When we consider that probably over one and a quarter billions are being spent each year for concrete in this country, the importance of spending this money for "permanent concrete" can well be understood and proper design and field control will accomplish that end.

The methods outlined are given with the desire that they will serve as one more step towards the end, that every pound of concrete making ability shall be extracted from every sack of cement used.

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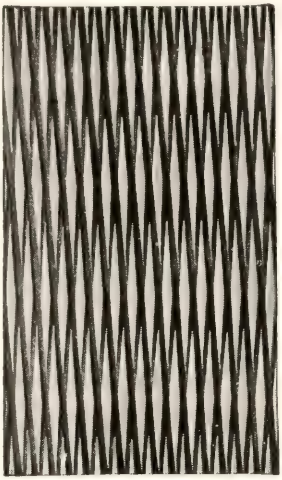

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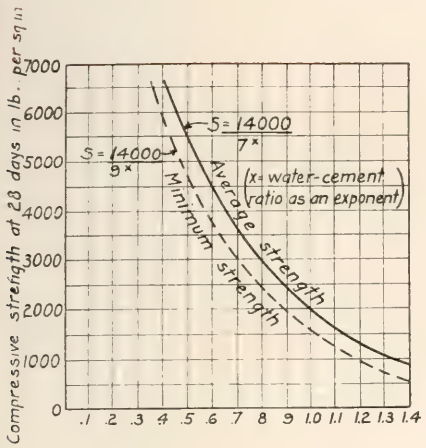
FIELD CONTROL OF CONCRETE

METHOD No. 1

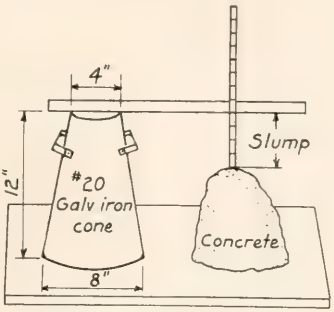
CONTROL OF WATER CONTENT



Water-ratio to volume of cement.

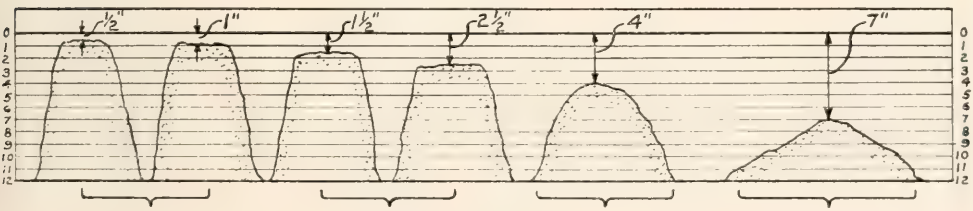
Note: Water-cement ratio 1.0= 1 cu. ft. water to 1 cu. ft. cement = 7.5 gal. to 1.0 sack (94 lb.).

Effect of Quantity of Mixing Water on Strength of Concrete.



Method: Fill cone with mixed concrete in three (3) layers, rod each layer with pointed 5/8" steel rod exactly thirty (30) times, lift cone vertically and measure slump as shown above.

THE SLUMP TEST.



Use for roads finished with mechanical tampers, pavement bases, floor tops.

Use for streets and roads finished by hand, mass concrete.

Use for all reinforced work (except as noted).

Note: This concrete will flow in 1:2½ chute.

Use for reinforced columns, thin sections, very heavily reinforced members.

Note: Never use greater slump than this.

CONCRETE SLUMPS.

APPROXIMATE QUANTITY MIXING WATER REQUIRED FOR CONCRETE

Mix as commonly expressed			Equivalent mix using mixed aggregate		Water required (Gallons per sack cement)	
Cement	Aggregate Sand	Aggregate Pebbles	Cement	Total Aggregate	Minimum	Maximum
1	1½	2½	1	3	5	5½
1	1½	3	1	4	5½	6
1	2	3	1	4½	5¾	6¼
1	2	4	1	5	6	6½
1	2½	5	1	6½	7¼	7¾
1	3	6	1	7¾	8¼	8¾

NOTE.

This table is approximate only, as quantity of water will vary with different moisture content of sand. Vary the water to maintain a constant slump under all conditions and a uniform strength concrete will be obtained.

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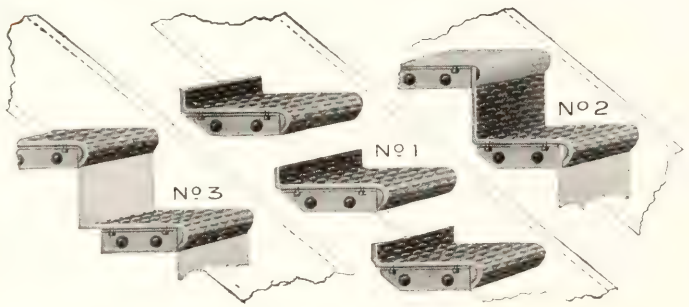

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FIELD CONTROL OF CONCRETE.

Method No. 2.

Field Corrections When Proportioning Concrete By Volume to Overcome Variations Due to Moisture Content of Sands.

Basic Requirements for Uniform Concrete:

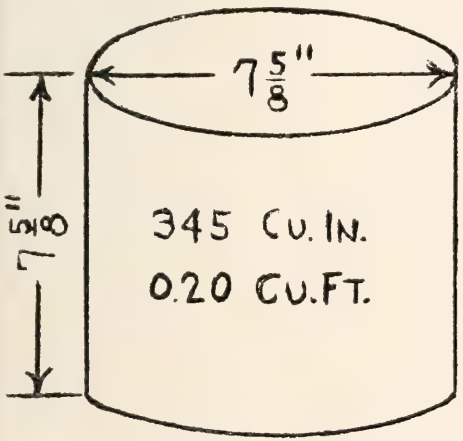
1. A uniform water-cement ratio.
2. A uniform number of grains of sand.
3. A uniform number of particles of stone or pebbles.

All sands "bulk" when damp (fine sands more than coarse sands) causing a loss in number of particles ranging from 5 to 38 per cent, consequently damp sand weighs less per cu. ft. than does dry sand. Three to four per cent (by weight) of water causes the greatest bulking in average sands.

Dry sand and pebbles when measured loose will show a loss of 5 or 6 per cent.

Remember: All concrete mixtures are based on **dry, rodded** measurements of both fine and coarse aggregates.

How to Measure Aggregates:



1. Use receptacle with diameter and height equal. (A convenient size is 7⅝" diameter by 7⅝" height, holding ⅕ cu. ft.
2. Dry aggregate thoroughly.
3. Fill in 3 layers, rodding each layer as placed, 30 times with pointed ⅝" steel rod.
4. Heap up, level off, weigh and calculate weight per cu. ft.
5. Fill with loose, damp sand as used on the job and weigh.
6. Dry same sand, weigh and calculate weight of water in a cu. ft. from difference between 5 and 6.

Example No. 1.

a. Concrete mix 1:2:4.

b. Water-Cement ratio 0.9 (0.9 cu. ft. water per sack cement = 7.5 x 0.9 = 6.75 gal. water per sack).

c. 4 sack batch.

d. Minimum strength 2000 lb. per sq. in at 28 days.

e. From 4 we find dry, rodded sand weighs 112 lb. per cu. ft.

f. From 5 we find damp, loose sand weighs 93 lb. per cu. ft.

g. From 6 we find 2.79 lb. water in 93 lb. (1 cu. ft.) loose damp sand = 3% by weight.

h. For each 4 sack batch we require 8 cu. ft. dry rodded sand and 16 cu. ft. pebbles.

i. 8 x 112 (See e) = 896 lb. (dry, rodded sand required).

j. 93 (See f) — 2.79 (See g) = 90.21 = weight of sand particles in one cu. ft. loose, damp sand.

k. 896 (See i) ÷ 90.21 (See j) = 90.93 = cu. ft. loose, damp sand required per 4 sack batch.

l. 4 (sack cement) x 0.9 (W/C) = 3.6 (cu. ft. water) x 62.5 (wgt. 1 cu. ft.) = 225.0 lb. water required.

m. 9.93 (See k) x 2.79 (See g) = 27.7 lb. water in sand.

n. 225.0 (See l) = 27.7 (See m) = 197.3 lb. ÷ 8.35 (wgt. 1 gal. water) = 23.6 gal. water to be put in mixer per 4 sack batch.

Therefore the Field Mix is:

4 sacks cement.
9.93 cu. ft. sand (loose, damp)
16.0 cu. ft. pebbles (no correction made).
23.6 gal. water.

Example No. 2.

Same as No. 1 except that sand is dry but is measured loose.

a. By measurement we find loose, dry sand weighs 106.7 lb. per cu. ft.

b. From (i) we have 896 ÷ 106.7 = 8.4 cu. ft. loose sand required.

c. From (l) we have 225 ÷ 8.35 = 26.9 gal. water.

Therefore the Field Mix is:

4 sacks cement.
8.4 cu. ft. loose dry sand.
16.0 cu. ft. pebbles.
26.9 gal. water.

FIELD CONTROL OF CONCRETE.

Method No. 3.

PROPORTIONING CONCRETE BY WEIGHT.

Example.

a. Concrete mix 1:2:4.

b. Water-cement ratio 0.8 (0.8 cu. ft. water to 1.0 cu. ft. cement = 7.5 x 0.8 = 6.0 gal. to 1.0 sack).

c. 5 sack batch. (1 sack = 1 cu. ft.)

d. Strength desired 2500 lb. per sq. in. at 28 days.

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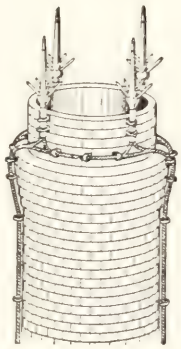

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e. From 4 under Method No. 2 we find that dry rodded sand weighs 112 lb. per cu. ft.

f. From 5 under Method No. 2 we find damp, loose sand weighs 95 lb. per cu. ft.

g. From 6 under Method No. 2 we find 5.7 lb. water in 95 lb. (1 cu. ft.) damp, loose sand = 6% by weight.

h. From 4 under Method No. 2 we find dry rodded pebbles weigh 110 lb. per cu. ft.

i. From 5 under Method No. 2 we find damp, loose pebbles weigh 104 lb. per cu. ft.

j. From 6 under Method No. 2 we find 2.1 lb. water in 104 lb. (1 cu. ft.) damp, loose pebbles = 2% by weight.

k. For a 5 sack batch we require 10 cu. ft. sand and from "e" we get 10 x 112 = **1120 lb. dry rodded sand.**

l. For a 5 sack batch we require 20 cu. ft. pebbles and from "h" we get 20 x 110 = **2200 lb. dry rodded** pebbles.

m. From "g" we find 6% of damp, loose sand is water, therefore 1120 (See "k") ÷ .94 = **1191.5 lb. damp, loose** sand is required to be the equivalent of 1120 lb. dry, rodded sand.

n. By same reasoning 2200 (See "l") ÷ 0.98 = **2244.9 lb. damp, loose pebbles** are required.

o. Water in the sand = 1191.5 (See "m") x .06 (See "g") = 71.5 lb.

p. Water in the pebbles = 2244.9 (See "n") x .02 (See "j") = 44.9 lb.

q. Total water in aggregate = 71.5 + 44.9 = 116.4 ÷ 8.33 (wgt. 1 gal.) = 14.0 gal.

r. Total water for batch = 5 (See "c") x 7.5 (gal. per cu. ft.) = 37.5 x 0.8 (See "b") = 30.0 gal.

s. 30.0 — 14.0 = 16 gal. (r — q).

Therefore the Field Mix is:

5 sacks cement (See "c").
1191.5 lb. sand damp, loose (See "m").
2244.9 lb. pebbles, damp loose (See "n").
Water = 16.0 gal. (See "s").

FIELD CONTROL OF CONCRETE.

Method No. 4.

PROPORTIONING CONCRETE BY THE INUNDATION METHOD.

The most accurate method of measuring sand and water is to pour or shovel **sand into water.** This automatically eliminates all variations due to "bulking".

Example:

1. Concrete mixture 1:2:4.
2. Water-cement ratio 1.10 (1.1 cu. ft. water to 1 cu. ft. cement) = 7.5 (gal. in 1 cu. ft.) x 1.1 = 8.25 gal. to 1.0 sack.
3. 6 sack batch (1 sack = 1 cu ft.).
4. Find weight of 1.0 cu. ft. of **dry, rodded** sand. Assume for example 115 lb. per cu. ft.
5. Find weight of 1.0 cu. ft. of **dry, rodded** pebbles or stone. Assume 110 lb. per cu. ft.
6. Find weight of 1.0 cu. ft. of **loose, damp** pebbles or stone. Assume 104 lb. per cu. ft.
7. Find weight and percentage of water in 1.0 cu. ft. of loose, damp stone. Assume for example 2.1 lb. water in 1.0 cu. ft. = 2% by weight.
8. Find weight of 1.0 cu. ft. of **inundated** sand. Use 1.0 cu. ft. watertight box, fill ⅔ full of water, pour sand into water until sand is level with top, weigh and deduct weight of box. Assume 125 lb. per cu. ft. for example.
9. Find weight of dry sand and water in 1.0 cu. ft. of inundated sand. Pour out water in 8, dry and weigh sand. For example use 105 lb. sand. 125 — 105 = 20 lb. water.
10. From 3 we have 6 x 2 (See 1) x 115 (See 4) = 1380 lb. dry, rodded sand. 6 x 4 (See 1) x 110 (See 5) = 2640 lb. dry, rodded pebbles. 6 x 8.25 (See 2) x 8.33 (wgt. 1 gal.) = 412.3 lb. water = total required.
11. From 10 and 9 we have: 1380 ÷ 105 = **1314 cu. ft. inundated** sand, 2640 ÷ 0.98 (See 7) = 2695.9 lb. = 25.92 cu. ft. loose, damp pebbles. 2695.9 x .02 (See 7) = 53.9 lb. water in pebbles. 13.14 (See 11) x 20 (See 9) = 262.8 lb. water in inundated sand. 262.8 + 53.9 = 316.7 lb. water in sand and pebbles. 412.3 (See 10) — 316.7 = 95.6 = 11.48 gal. **COMPLEMENT** water.

Field Mix:

6 sacks cement (See 3).
13.14 cu. ft. inundated sand (See 11).
25.92 cu. ft. loose, damp pebbles (See 11).
11.48 gal. additional or complement water (See 11).

Note 1.

Should water required for inundation, plus water in pebbles, exceed amount of water required for specified water-cement ratio **do not use Inundation Method.** (This will seldom occur except in very rich mixtures.)

Note 2.

This method is protected by patents issued to the White Cons. Co., 95 Madison Ave., New York City. Consult them before using.

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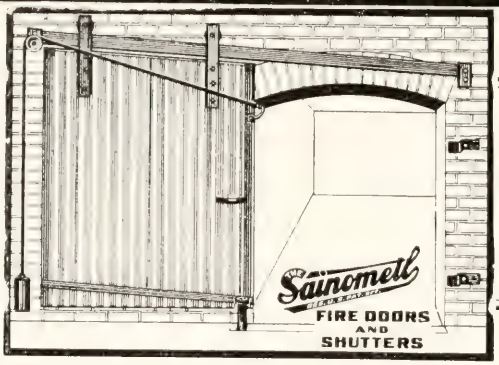

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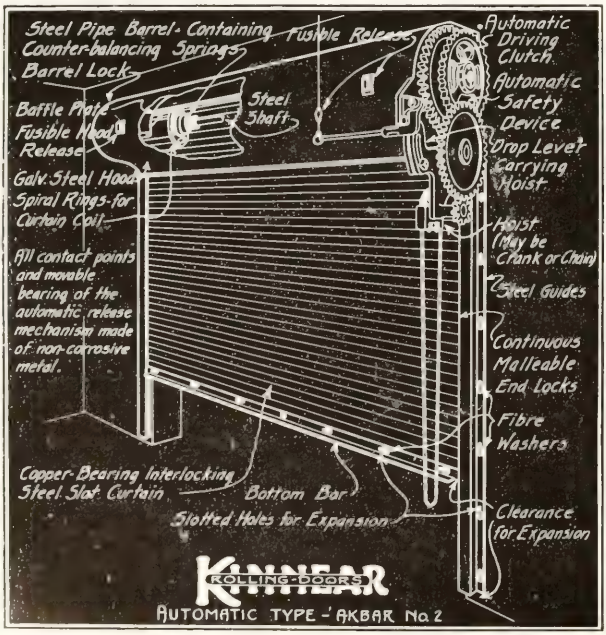

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COMBINATION HOLLOW TILE AND CONCRETE FLOOR AND ROOF CONSTRUCTION

In the development of the long span fireproof construction, hollow tile has been used very extensively for many years. Tests of combination hollow tile and concrete floors have shown remarkable results in stiffness and in strength.

It has been clearly established that hollow tile is not merely a filler or fireproof covering but that it is also a standard structural material, capable of resisting compressive and shearing stresses.

This type of floor construction is equally well adapted to steel skeleton or reinforced concrete, or wall bearing construction and has been successfully used in numerous buildings of various kinds. It is especially economical for use in office buildings, hotels, apartment buildings, hospitals and residences, where the spans are from 15′ to 20′. It is often used for much larger spans, even as high as 35′ or 40′.

Hollow tile is a very efficient insulator of sound, which makes it desirable for floor construction. A flat ceiling is provided ready for plastering without the use of a suspended ceiling. This means that not only a saving in time and material, but also, by the omission of the suspended ceiling, a greater sound deadening is provided.

Plastering on ceilings of combination hollow tile and concrete costs less than on suspended ceilings, because the plastering surface is flat and unyielding and less material is required.

In the one way system, the joints between in adjacent rows should be staggered. This is accomplished by starting alternate rows with half length tile. The strong bond between the tile and the concrete, aided by the mechanical bond of the dove-tailed scoring cause the two materials to act as if they were monolithic.

Some architects desire a ceiling with an all tile surface which may be obtained by laying a tile slab at the bottom of the joist between the rows of hollow tile. This slab is scored on both sides so as to furnish a bond with the concrete above and the plaster below.

In the combination hollow tile and concrete floors the hollow tile fireproofs the load bearing concrete above the neutral axis and also furnishes additional protection for the reinforcing at the sides of the concrete joists.

SPECIFICATION NOTES ON COMBINATION HOLLOW TILE AND CONCRETE FLOORS

General.

In general, combination hollow tile and concrete floor construction consists of reinforced concrete joists between rows of hollow tile. All tile are covered with a concrete top cast monolithic with a concrete joist. All floor slabs should have at least 4″ bearings on the walls.

Concrete.

All concrete used in the floor construction shall consist of one part approved Portland cement, two parts clean sharp sand and fou parts broken stone or gravel of such size as will pass through one-half inch ring. It shall be a moderately wet mixture and must be well spaded and worked around the reinforcing steel after pouring. The placing of concrete must be a continuous operation and the full depth of floor must be poured at one time. All tile must be wet before concrete is placed so as to insure a good bond. When the slab cannot be completed in a single operation, the work shall be stopped along the center of a row of tile with a vertical joint. In pouring the ribs the concrete should not be dumped into the joist, but on the previously placed concrete and worked forward, allowing the mortar to flow ahead in the joist.

Reinforcing Steel.

Deformed or cold twisted bars of hard grade steel, offering a mechanical bond with the concrete, are to be used as reinforcing for the floor construction. They shall be free from mill or rust scales. The reinforcing should be placed so as to allow at least a ¾″ covering of concrete on all sides.

Tile.

The depth of the hollow tile and the size of the reinforcing steel are determined by the span and the load to be carried as indicated on the structural drawings. The hollow tile should be hard burned, free from damaging imperfections and properly scored on all exterior surfaces. The joists between the tile and adjacent rows should be staggered by starting each alternate row with a half-length tile.

Forms.

Forms must be of such size lumber and so braced as to prevent deflection and must be provided in such quantity as not to delay the progress of the work. Care must be taken not to remove the forms before the concrete is set. Under long spans the center row of supports must be maintained for at least three weeks after the concrete has been poured. In cold weather, the contractor must leave the forms in place until directed by the architect to remove them. No concrete shall be poured when the temperature is below freezing unless provision has been made for heating and protecting the work.

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SPECIFICATIONS FOR ERECTING METAL LATH

(Short Form)

Recommended by Associated Metal Lath Manufacturers

(A) MINIMUM WEIGHTS OF METAL LATH (Pounds per square yard).

(a) **Expanded Metal Lath.**

For Interior Work.

(Spacing is maximum permissible for weight of lath specified.)

For vertical position attached to wood studs, 16 inches on centers, 2.5 lbs. (see note below).

For horizontal position attached to wood supports 16 inches on center 3.0 lbs.

For vertical position attached to metal studs 12 and 16 inches on center 2.2 and 2.5 lbs. respectively.

For horizontal position attached to metal supports 12 and 16 inches on center 3.0 and 3.4 lbs. per sq. yd. respectively.

NOTE: The above requirements for Expanded Metal Lath attached to wood studs for interior work, are in accordance with the Underwriter's one-hour rating on Metal Lath protected lumber. Where Underwriter's Standards are not exacted, Expanded Metal Lath weighing 2.2 pounds per square yard is regularly manufactured and available for use on wood studs spaced not to exceed 16 inches on centers.

(b) **Three-eighths-Inch Rib Lath**—For vertical position attached to wood or metal supports spaced not to exceed 19½, 24, 30 and 36 inches—2.5, 3.0, 3.5, 4.0 lbs. per sq. yd. respectively.

For horizontal position attached to wood or metal supports spaced not to exceed 19½, 24 and 30 inches—3.0, 3.5 and 4.0 lbs. per sq. yd. respectively.

(c) **Flat Rib Lath.**—Attached to wood or metal supports for a maximum spacing of 24 inches in vertical position, and 19½ inches for horizontal position—3.0 lbs.

For Exterior Work.

For any position attached to wood, metal masonry, etc., 3.4 lbs.

(B) MINIMUM SIZE AND SPACING OF ATTACHMENTS FOR METAL LATH.

(a) **Attachment to Wood Supports.**—Metal lath shall be attached to wood studs and joists by not less than 6d nails or 1¼ in. No. 14 gauge wire staples driven to a penetration of not less than ⅞ in. and spaced not to exceed 6 in. on center, provided further than ¾-in., No. 14 gauge wire staples may be used in lieu of 1¼ in. staples, when Underwriter's Standards are not exacted.

(b) **Attachment to Metal Supports.**—Metal Lath shall be wired to metal supports at intervals not exceeding 6 in. with not less than No. 18 gauge galvanized soft annealed wire and a tie shall always occur where sides of sheets lap at channels.

(C) SOLID OR HOLLOW, METAL STUD PARTITIONS.

(a) **Size and Weight of Metal Channels.**—Metal studs for solid or hollow partitions shall be not less than ¾-in. cold or hot rolled channels weighing not less than 276 lbs. per 1,000 lin. ft. and spacing of studs shall conform with weight of lath as in Article "A" of these specifications.

(b) **Erection of Partitions.**—When floor and ceiling runners are used they shall be not less than 1-in. cold or hot rolled channels weighing not less than 330 lbs. per 1,000 lin. ft., and shall be securely bolted or clamped to the floor beams, soffits of concrete or terra cotta arches and substantially secured to top of concrete or tile floors. Hollow partitions shall have parallel lines of such floor and ceiling runners.

Studs shall be secured in position by bolting to floor and ceiling runners by bending a shoe at the end of studs and wiring, nailing or bolting to plates, or by inserting ends of studs in holes drilled in top of concrete or other masonry floors or punched in soffits of masonry ceilings, or by bending a shoe at ends of studs and anchoring to holes drilled in floors and ceilings, or where metal lath ceilings are used a small hole shall be made in the ceiling lath and the end of the channel allowed to project through it and be wired to a runner channel attached to the ceiling lath.

Channels of a length shorter than the total height of the partitions are permissible, but when pieced out with short lengths the splicing shall be made by lapping not less than 8 in. with the flanges interlocked and securely wired together.

For hollow partitions the double studding shall be spaced the proper distance, with spacers not over 3 ft. centers.

(D) SUSPENDED CEILINGS UNDER STEEL OR CONCRETE BEAMS, JOISTS OR PURLINS, OR CONCRETE OR HOLLOW TILE FLOORS.

(a) **Hangers.**—The minimum size for hangers shall be No. 8 galvanized wire, 1 by $\frac{3}{16}$ in. flat steel, or $\frac{7}{32}$ in. round mild steel rods. Hangers shall be spaced not to exceed 4 ft. center to center in both directions. (See note under paragraph (b) below.)

(b) **Runner Channels** shall not be less than 1½ in. cold or hot rolled channels weighing not less than 442 lbs. per 1,000 lin. ft. and shall be spaced not to exceed 4 ft. on centers.

NOTE: Runner channels may be ¾-in. weighing not less than 276 lbs. per 1,000 lin. ft. But in such cases hangers as in (a) above shall be spaced not to exceed 2 ft. centers along the ¾-in. runner channels, or the hangers shall be of such size and spacing as to provide equivalent support.

(c) **Furring Channels** shall be no less than ¾-in. cold or hot rolled channels weighing not less than 276 lbs. per 1,000 lin. ft. and shall be spaced to correspond with the spacing of horizontal metal supports as specified in Article "A" of these specifications.

(d) **Weights of Metal Lath.**—No Metal Lath used for suspended ceilings shall have a weight less than 3 lbs. per sq. yd.

(e) **Tie Wire** for attaching Metal Lath to channels shall be not less than No. 18 gauge, galvanized soft annealed wire. Tie Wire used for securing furring channels to runner channels shall be not less than No. 16 ga. galv. soft annealed wire.

(f) **Erection of Channel Frame.**—Upper ends of hangers of wire, rods or flats shall be of sufficient length to wrap around beams or to provide a suitable anchorage in the concrete or tile. Where steel beams or purlins are not more than 4 ft. center to center, hangers may be attached directly to them. When hangers are hung from concrete beams or arches, the hangers shall be placed before concrete is poured. When ceilings are hung from terra cotta floors, hangers shall be installed after the tile is in place. A hole shall be bored in the underside of the tile and the hanger inserted and securely anchored with either a cross piece of steel rod or toggle bolt, or the hanger may extend clear through the tile and be secured on the upper side by means of a steel rod or toggle bolt.

Lower ends of wire hangers shall be of sufficient length to wrap around the runner

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channels and be given three twists around itself. Lower ends of rod hangers shall be of sufficient length to wrap around the runner channel with two twists or be securely wired to same. Lower ends of flat steel hangers shall have holes punched at the proper distance to which the runner channel shall be bolted with not less than ⅜-in. diameter bolts.

Furring channels shall be erected at right angles to the runner channels and be securely wired to them by at least three strands of No. 16 galv. annealed wire at each crossing or by No. 9 wire, hair-pin clips.

(E) ERECTION OF METAL LATH (General Note).

(a) Metal Lath shall be applied with the long dimension of the sheet across the supports (studs, joists, furring strips, or channels.)

(b) Sheets shall be attached to supports at intervals and by attachments as specified elsewhere herein and an attachment shall always occur where sides of sheets lap at supports. There shall be one tie on side laps half way between supports.

(c) Expanded Metal Lath shall be lapped at sides of sheets not less than ½ in. and at ends not less than 1 in. End laps of sheets should generally occur only over supports, if between supports, sheets shall be securely tied or laced with No. 18 ga. galvanized soft annealed wire.

(d) Rib Lath shall be lapped at sides by nesting outside ribs, and at ends 1 in. End laps shall be as in preceding paragraph.

(H) MINIMUM THICKNESS FOR PLASTER AND STUCCO.

Thickness of plaster for interior work shall be not less than ⅝ in. over face of lath. Thickness of Portland Cement Stucco for exterior work (sheathed construction) shall be not less than ⅞ in. over face of lath and total thickness for back plastered stucco construction shall be not less than 1½ in.

(I) METAL LATH ALTERNATE SPECIFICATIONS.

Plastering specifications for residences in which wood lath predominates should call for Expanded Metal Lath as follows:

(1) **Metal Lath Over the Heating Plant and Fuel Storage:**

That portion of the basement ceiling directly over the heating plant and fuel storage and extending 3 feet beyond the outlines thereof and that portion of such ceiling over hot air and smoke pipes shall be protected by Expanded Metal Lath and plaster.

(2) **Bathroom Wainscot:**

The entire bath room wainscot shall be lathed with Expanded Metal Lath (whether for tile backing or for plaster).

In addition to the above, contractor shall submit bids on the following two alternates:

ALTERNATE I.

Furnish and Install:

(1) Expanded Metal Lath on the ceilings of the living room, dining room, entry hall, and around and under the stairs and stairwell where exposed to view from the main floor.

(2) A 12-inch strip of Metal Lath bent into the shape of an "L" (Cornerite) and applied over wood lath in the corners of the living room, dining room and stair hall (to prevent corner cracks) wherever wood lath is used.

ALTERNATE II.

(In Addition to the Preceding)

Furnish and Install:

(1) Expanded Metal Lath for the walls of the living room, dining room and entry hall.

(2) Metal Lath for the balance of the basement ceiling.

WEIGHTS AND ATTACHMENTS FOR METAL LATH.

Note: Minimum weights of Expanded Metal Lath required for Metal Lath Alternate Specifications shall be as follows:

For walls and partitions and cornerite, 2.2 pounds per square yard.

For ceilings, 3 pounds per square yard.

Metal Lath shall be attached to wood studs and wood joists by not less than 6d nails or by equivalent staples.

New Complete Metal Lath Specifications Available.

Architects will find the new complete metal lath specifications, issued by the Associated Metal Lath Mfrs., of great help in preparing details for interior construction as well as for stucco. Weights of metal lath, recommended methods of attaching it to supporting framework and details for the latter are given in clear, easily-read type, and most of the seventeen types of construction described are illustrated by line drawings.

The specifications are written upon the basis of weight only to insure equality of competition and facilitate accurate inspection in the field. This is the method adopted at the conference of producers, distributors and users of Metal Lath, held at the Department of Commerce under the auspices of the Division of Simplified Practice, and now issued by the U. S. Bureau of Standards as Simplified Practice Recommendation No. 3, Metal Lath (For copies, address Government Printing Office, Washington, D. C.). Among other advantages to the architect, this system has reduced the 125 varieties of Metal Lath, which the architect needed to be familiar with, to only 24, distributed between Expanded Metal Lath, Flat Rib Lath and ⅜" Rib Lath corresponding to an 80.8% elimination of varieties.

Special attention is called to the specifications for 2-inch solid partitions. Manufacturers of electrical switches and outlets have recently put on the market a complete line of shallow electric devices suitable for solid partitions, eliminating a difficulty which architects had experienced heretofore.

Underwriter's Laboratories Accord Full One-Hour Rating to Metal Lath and Plaster Protected Lumber.

Of outstanding importance to architects is the epoch-making discovery that metal lath and plaster definitely protects lumber joists and studs for upwards of one hour. The Underwriter's Laboratories have accorded such construction the full 1-hour rating.

In contrast with the exceptionally low 4-minute rating established by the same authorities as the interval of time beyond which ordinary lath permits fire to break into a wood studded partition, 1-hour metal lath protected construction is vitally significant.

The possibility of using such low cost protection for economical lumber construction puts an entirely new angle on the design of all buildings not required to be fully fireproof. It assures an unusual degree of fire-resistiveness and safety to life of occupants of homes if used on the places most vulnerable to fire—basement ceilings, over heating plants and fuel storage, around and under stairs, bearing partitions, and the underside of inhabited floors, at insignificant expense.

Apartment houses and hotels, small schools and mercantile buildings should have the structural lumber similarly protected by metal lath.

Engineering Service to Architects.

Attention is called to the Engineering Service of the Associated Metal Lath Manufacturers which is extended without cost to Architects and Engineers for the purpose of assisting in the preparation of specifications governing construction of steel supports for suspended ceilings and similar special construction for theatres, churches, lodge halls, etc., where the correct method of securing the suspended ceiling to the construction above requires special attention.

Complete specifications will be sent upon request to the Associated Metal Lath Manufacturers, 123 W. Madison St., Chicago.

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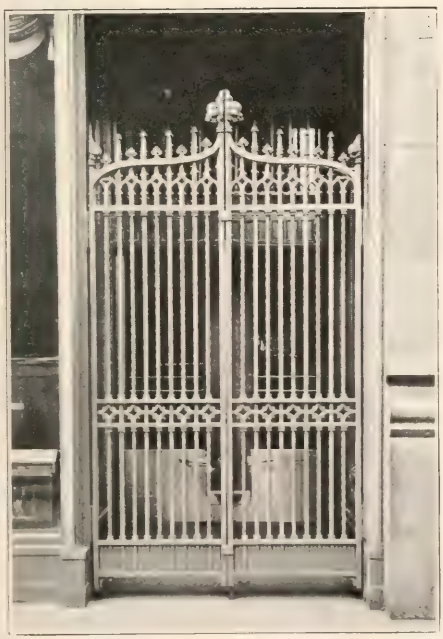

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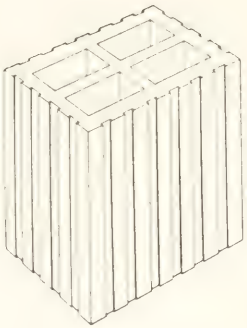

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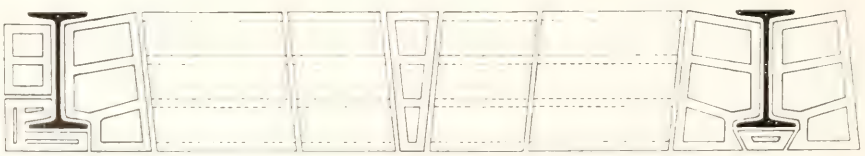

SPECIFICATIONS RECOMMENDED FOR HOLLOW TILE FIREPROOFING

(1) In General:

The contractor for the fireproofing shall furnish all the Hollow Tile material required for the floor and roof construction, including the fireproofing of all structural steel work, beams, girders, lintels, columns, etc., excepting where steel is indicated as being encased in the wall or other masonry, or specifically referred to as being left exposed (such as roof trusses, elevator sheave beams, etc.), also the Hollow Tile for partitions, furring and such other work as indicated on the drawings.

This contractor shall furnish all labor, transportation, tools and equipment and all other materials required to erect the Hollow Tile fireproofing and other construction in accordance with the drawings and as hereinafter specified, all conforming to the best and latest practice and to the satisfaction of the architect; only skilled tile setters to be employed for the setting.

Contractors shall carefully examine the steel framing, drawings and structural details and provide for the complete and proper fireproofing of the structural frame.

(2) Material:

All Hollow Tile fireproofing shall be of hard burned (dense) or (semi-porous) ware that will develop a crushing strength of at least 1525 pounds per square inch of net sectional area of the tile when tested on end, and stamped with the Manufacturer's name or that of his association. No badly split, cracked, warped or underburnt tile shall be used.

Book tile roofing, solid beam and girder covering (nailing tile) and such other items as are specifically so noted shall be hard burned, full-porous ware.

All Hollow Tile fireproofing shall be capable of withstanding the tests prescribed by the "National Board of Fire Underwriters" standards for fire resistive floor, wall and partition construction.

(3) Size and Dimensions of Tile:

All Hollow Tile arching shall be of the shape required to carry and transmit the loads with an ample factor of safety.

Floor arch tile shall have the outside shells not less than ¾" in thickness and the webs not less than ⅝" in thickness, excepting that the shells and webs of keys and skewbacks, or other shapes that must resist both compression and shearing stress, shall be thicker when required. Skewbacks shall be designed to resist the combined shear and thrust from arch and be formed to fit and protect the various steel sections on which they are set.

Partition tile shall have shells not less than ⅝" and webs equal in thickness, number and arrangement to Hollow Building Tile Association Standard.

Cross webs in all arch and fireproofing shall be spaced not over 4" on centers and all blocks 8" or more in thickness shall have at least one mid-web.

The faces of all tile that are to receive plastering or mortar shall have the standard scoring. The thickness of the shells of side construction arches shall be made sufficient to resist the combined compression and shearing stresses, with ample fillets at all intersections of webs and shells.

Beam, girder and lintel fireproofing shapes when hollow shall have shells at least ⅝" in thickness, or if solid, be of porous or semi-porous ware and at least 1½" thick at extreme edge of metal.

(4) Fireproofing Steel:

The thickness of fireproofing around steel members shall in no case be less than the following (and thicker where necessary to conform to existing State or Municipal ordinances or by-laws):

Soffit coverings on lower flange of beams supporting flat arches shall be 1½" thick if of solid material and 2" thick if made hollow.

Covering on beams and girders extending below the soffit of arches: at least 2" thick for plain rolled sections, plate girders, trusses, etc. Web covering shall be built out solidly to the thickness required in all cases.

Solid Tile column fireproofing for round or other special columns shall be at least 2½" in thickness of porous or semi-porous ware.

(5) Detail Drawings:

This contractor shall submit to the architects for approval any required detail drawings, showing the form, section and method of applying the fireproofing to the steel work, etc., before starting the manufacture of material. Details to be full size where any special shapes are required.

Stock shapes may be used throughout for the fireproofing of beams and girders, columns, etc., where they conform to the requirements of this specification and fit the contour of the steel sections. Elsewhere the contracts shall furnish, without extra cost, all other shapes required to properly fit and encase the steel work.

(6) Scaffolding and Centers:

Contractor shall provide his own hoisting rig and all scaffolding, centers and forms required for the setting of his work. Scaffolding and centers to be provided in sufficient quantity to insure the rate of progress outlined in contract.

This contractor shall also furnish the proper protection for his men and for those working under him, as required by the City and State laws.

(7) Mortar and Laying:

All arches, fireproofing, partitions, furring, etc., shall be set in cement mortar composed by volumne of one part (approved brand) Portland cement to three parts clean sharp sand. Not over 15% of the cement by volume of hydrated lime may be added.

Cements, sand, etc., shall conform to the requirements elsewhere specified under the heading of "Masonry."

All steel work shall be coated with this mortar just ahead of the setting of fireproofing.

All tile shall be laid with full butted end and side joints and shall be shoved to a bearing on a full bed of mortar with as close a joint as possible, pointing up and filling all crevices with mortar.

In warm weather all tile shall be thoroughly wetted before setting. Frost shall be driven from the tile by heating when setting is carried on during cold weather and no fireproofing shall be set when the temperature is below 20 degrees Fahrenheit without the permission of the architect

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Contractors' Tile Fireproofing

Floor Arches *Partitions*

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(8) Flat Arches:

All floors throughout (including the main roof and the roof in light court), except where otherwise noted, shall be constructed of ..." deep end construction flat arches having (side construction) skewbacks and keys of the sizes required to fit the several spans without cutting.

Any additional keying or wedging required shall be done with tile slabs or slate.

Solid beam soffit tile shall be separate from the skewbacks and of the proper size, having bevelled sides so as to be securely keyed in place by the skewbacks.

Skewbacks shall be of the size required and be properly formed or coped to fit the various beam sections.

Whenever possible, any openings required in arches for pipes, etc., shall be formed or left at the time of setting so as to avoid later cutting.

(9) Segmental Arches:

All.....shall be 6" (or 8") deep, side construction segmental arches, set on skewbacks of the forms indicated on drawings, properly encasing the lower flange of beams, all segment lengtheners to be uniform size, except where smaller sizes are required for keying up, and shall be set with broken joints in each course, carefully fitting up to and between tie rods by using the required short lengths for starters and closures.

Solid beam soffit tile shall be separate from the skewback and of the proper size, having bevelled sides so as to be securely keyed in place by the skewbacks.

(10) Beam and Girder Covering:

All beams, girders, or other steel members, extending below the soffit of arches, shall be encased in Hollow Tile of the thickness specified, all to be properly fitted and set with well filled mortar joints encasing the entire length of beam and where necessary be securely strapped or clipped in place with 1" by No. 16 gauge band iron or No. 10 gauge galvanized iron wire. Where metal fastening is necessary, as in the case of wide soffits, the soffit tile shall be hollow and the metal clamp be arranged in the hollow space; these soffit tile to be also keyed into place by mortar joints. The fireproofing of main carrying beams and girders shall be independent of the floor arch construction and shal extend up to top flange so that openings for pipes, etc., that may be left or cut will not expose the webs or flanges of any members of the structural frame. All spandrel beams and girders and other lintel members shall be protected with the tile fireproofing where not indicated as being encased in the masonry of walls.

(11) Book Tile Roofing:

The roofs of penthouses and vent shafts, also the backs and ends of saw-tooth skylights and mansard roof and top of cornice and the pitched roofs of tower or dome, shall be constructed of 3" book tile, set on "T" irons which will be provided and erected by the steel contractor.

The floor of bulkheads in show windows shall also be constructed of book tile.

(12) Suspended Ceilings:

The ceiling under roof in (top) story and the ceiling of boiler room (also the soffits of stairs, where so indicated) shall be constructed of 3" book tile ceiling bolcks, set on "T" iron framing provided and erected by the steel contractor.

Book tile for ceilings shall be coped so as to give a level ceiling and before setting the lower flange of "T" irons shall be wrapped with a strip of galvanized light weight diamond mesh expanded metal, or galvanized woven wire mesh.

(13) Column Covering:

All interior columns (and such other columns that are so indicated on the drawings) shall be encased with Hollow Tile as indicated, set 1" free of the steel; all channel spaces in columns shall first be filled in solid with Hollow Tile or a fine stone or gravel concrete, or broken tile and cement mortar.

The steel column shall be plastered with a full ½" coat of Portland cement mortar just in advance of the setting of the tile covering.

Column covering shall in all cases start on the top of the fireproof floor construction and be carried up to the underside of fireproof ceiling above, each course of tile to be set breaking joint with the one below and be warped once in every course with 10-lb. galvanized iron wire, or be tied together with "U" shaped clips of band iron in each course.

Where so indicated, column covering shall have rounded corners.

No piping shall be enclosed in the column fireproofing, excepting electric conduits, not over ⅝" in size, built into the channel space before the column covering is set. These conduits shall be grouted in solid with at least 3" of solid material between conduit and the face of steel. All other piping at columns shall be separately inclosed in ducts as indicated and hereinafter specified.

(14) Wall Furring:

The furring of exterior walls (and the party walls where so shown, including the walls of basement), where free standing, shall be built of 3" (or 4") hollow partition tile, the same as partitions, elsewhere the furring of all exterior and party walls shall consist of 2" split furring tile built against and secured to the brick or other masonry with approved metal wall ties previously built into the masonry, or with galvanized heavy 4" wire nails driven into the joints of same every second course in height and not over 3' 0" apart.

Wall furring, where so indicated, shall be returned into jambs at windows (including the furring down at windows soffit).

(15) Special Furring, Pipe Enclosure, Etc.:

Where indicated on drawings, the walls, columns, piers, etc., shall be furred out to the lines required by the architectural details for the special form and finish of the room, corridors, etc., as indicated, forming all offsets, reveals pilasters, etc., using partition tile of the required size. In general this work shall be done with 3" partition tile with brace or cross walls of same size blocks wherever required. Cross walls shall

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be anchored or tied into both furring and masonry.

All piping, conduits, etc., where so indicated shall be inclosed with 2" or 3" partition tile; chases in walls to be similarly covered. This work shall be independent of the column fireproofing and be arranged so that the piping is left accessible until after it has been tested.

(16) Partitions:

All partitions and interior division walls shall be built of light weight Hollow Partition Tile of the several thicknesses indicated on drawings. Sizes not marked on plans shall be as follows:

Partitions enclosing elevator and stair walls, pipe shaft, etc., and all partitions over 18' 0" in height to be 6" thick.

Division walls in stores on ground story to be 8".

All main and corridor partitions and all partitions around toilet rooms, etc., also all sub-dividing partitions over 14' 0" in height to be 4" thick.

All other partitions to be 3" thick.

All division walls, main and corridor partitions shall start directly on the arches; but sub-dividing partitions may be built on the floor filling and where so indicated shall be built on the top of finished floor to provide for tenent changes.

All partitions to be carried up to and be wedged tightly against the underside of fireproof ceiling or beams above.

Where there are more than two courses of partition tile the heads of doors or other openings in sub-dividing partitions and over all openings wider than 3' 6" jack arches, light steel lintels or suitable reinforcement of band iron shall be provided and similar lintels shall be provided over all openings in main partition wall furring, etc.

All partitions shall be built true to a line and plumb and at all intersections shall be bonded together or be tied with approved metal ties or with band iron. Provision shall be made for securely anchoring all heavy frames which are not fastened to the steel framing.

All partitions, furring, column casing or other items built with partition or furring tile shall be well bonded by breaking joints at least 3" in each course, all joints to be thoroughly bedded and flushed and pointed up with mortar.

Double partitions shall be bonded together and stiffened with cross walls of the same material, as shown on drawings. All anchors, ties, etc., required for this work to be furnished by this contractor.

(17) Vaults:

The lining of fireproof vaults shall consist of a 4" Hollow Partition Tile built 2" free of and anchored to the vault wall masonry by hollow header brick. The wall of storage vaults on .. stories shall consist of a double 4" partition tile (or a double 4" and 6" partition) breaking joints in each course. Vault doors to be securely anchored at least two courses deep in every second course.

(18) Pent Houses and Other Walls:

The walls of pent houses and vent shafts on roof (also the wall of pipe tunnel back of cornice) shall be built of 8" exterior wall tile having a deep scoring to receive the cement stucco. All openings in tile at the top of these walls shall be capped with a tile (slab) before the cresting or coping is set.

(19) Bulkheads and Skylight Curbs:

The bulkheads and skylight curbs where indicated as covered with sheet metal shall be built of 3" (or 4") thick Hollow Partition Tile. Elsewhere they shall be built of 6" (or 8") exterior wall tile same as pent houses. The roof of bulkheads (unless otherwise shown) shall be constructed of 3" book tile, set on loose "T" iron which will be furnished by another contractor but be set by this contractor.

(20) Miscellaneous Iron:

All loose light steel sections and miscellaneous ironwork occurring in connection with the Hollow Tile fireproofing work, excepting anchors, ties (reinforcement), band iron, etc., will be furnished by other contractors, but shall be set by this contractor without extra charge.

(21) Raised Floor:

The raised floors in toilet room where indicated shall be constructed of 3x12x18 book tile or heavy section partition tile set on dwarf walls of partition tile and brick. This work shall be so arranged as not to interfere with the installation of the plumbing work. These floors to be closed up only after the pipes have been tested and approved.

(22) Roof Fill and Finish:

Here specify cinder-fill and cinder, slag or sawdust concrete being careful to require protection against corrosion around pipes.

(23) Load Tests:

All Hollow Tile arches shall be capable of sustaining a load of three times the required live load, per square foot, and they shall be tested by the contractor where so directed by the architects.

(24) Cutting and Patching:

This contractor alone shall do all cutting and patching of the arching, beam, girder and column fireproofing that may be required for the roughing in of piping, etc., or the installation of other work, the cost of which (actual labor cost plus 10%) shall be reported to the general contractor (or architect), who will adjust same with the contractors for whom this work is done.

The cutting and patching of partitions and furring, etc., will be paid for by the contractors whose work occasions same.

All other cutting and patching and the repairing of all Hollow Tile work so as to leave the whole work perfect and complete shall be done by this contractor at his own expense.

(25) Removal of Rubbish:

Upon completion of the Hollow Tile fireproofing and whatever else required by the architect's superintendent, this contractor shall clean up and remove from the premises any refuse and surplus material resulting from this work, leaving the premises clear of such rubbish. This contractor, however, may use the broken tile in the floor filling, provided same is broken into **small pieces and kept free from plaster, wood chips and other rubbish.**

The Straus Building, Chicago, Ill. Graham, Anderson, Probst & White, Architects, Chicago, Ill.

"Stone was used in all of the great buildings in Rome, in the days of Caesar Augustus—its temples, amphitheatres, arches and monumental pillars."

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STANDARD FORM OF CUT STONE SPECIFICATION

For Indiana Oolitic Limestone

INDIANA LIMESTONE OR BEDFORD STONE

Indiana Limestone constitutes one of the great natural resources of the country. The industry has grown to such an extent that it is in no sense local or sectional but national in character, and since this stone is so extensively specified by Architects, these specifications and notes regarding its use have been included.

The Indiana Limestone Quarrymen's Association offers free technical service to Architects, who are requested to make use of the Service Department and Bureaus of the Association as a source of reliable and impartial information regarding the products of the industry and their proper and economical use, and for assistance on any problems pertaining to Indiana Limestone and its employment in building construction.

Chicago Branch Bureau of Service Department at Room 1503, London Guarantee Building, 360 N. Michigan Avenue. Service only, no sales, no reports to trade. Inquiries and consultations strictly confidential.

Notes on Standard Specifications for Indiana Limestone

Research work and investigations bearing on the subject of Specification requirements are beng conducted by the Technical Division of this Association, and it is the intention to revise this standard specification from time to time, in order to keep it up to date with the developments of this research work, or as may be found advisable to improve it and have it conform with the best modern engineering practice as applied to Building Construction.

Classification:

The Indiana Limestone Quarrymen's Association classifies the Industry's product by color-tone and texture as follows, and recommends the use of these terms to indicate the desired grades of stone which its members produce:

"Regular Grades"	"Special Grades"
Select Gray stock.	Rustic Buff.
Standard Gray stock.	Special Hard Buff.
Variegated Stock.	Special Hard Gray.
Select Buff stock.	Indiana Travertine, sawed either with or across the grain.
Standard Buff stock.	

Other specialties, ranging in color tone from very light, almost a cream white, to distinctly dark, are also usually available, samples of which will be furnished by the Association upon request. A general description of the various grades and recommendation as to their selection and employment is given below.

Architects should remember that the Association Classification of the Industry's product is for their direct benefit and the protection of their clients in the specifying of Indiana Limestone. The well known Oolitic Limestone of Indiana, formerly called Bedford Stone, is commercially available only in Lawrence and Monroe Counties, and the Architect should protect both his client and himself against substitutes. All of the long established and proven quarries from which this dependable stone has been produced for generations are located within these two counties.

The recommendations and standard practice of this Association are an effort to improve and standardize current usage and to assure the proper and economical use of its members' product in modern building construction. The standard practice of this Association is rapidly becoming universally recognized.

"Standard" stock is the standard product of the quarries, constituting the bulk of the total output. It is thoroughly sound stone, having a range of variation in color shades and texture not found in "Select," but which by reason of the nature of the deposit are confined within limits that make it impossible to determine at a distance of a few feet whether it is "Standard" or "Select" stock. Stone of the Standard Gray or Buff or of the Variegated classification is generally used for all purposes in the regular run of work.

"Select" or "No. 1" stock is much more uniform in color and texture than is required for all ordinary purposes in general building construction. Select stock is recommended for entrance work and those portions of a building within ready range of vision, for carving, sculpture, certain interior work and other special uses. It is considered an unnecessary, if not wasteful, expense to specify Select stock for the entire exterior of the average building, or to use this grade of stone for heavy cornices and other work having fairly large scale detail placed well above the range of close inspection, as the difference in texture between "Select" and "Standard" rock in such position cannot be noted.

On the other hand, it is not proper to mix Standard and Select stock or Standard and a coarser variety in any well defined architectural member, such as Grade or Base Course, Belt Course or Cornice, etc. and Architects are justified in insisting that the Cut Stone Contractor use some judgment in selecting the stock of any grade for the several portions of the work.

"Rustic" stock, which is only available in Buff color, has more variation in color-tone and texture, having a wider range of granular formation than either Standard or Select stock. This grade is particularly suitable for the sawed ashlar facing of walls, and for that purpose may be combined with trim of either Standard or Select stock.

"Rustic" is not generally to be recommended to take the place of Standard, or for positions in the building on which there is much cutting and moulded work, on account of its texture and hardness, with resultant increase in cost of cutting, but may be used to advantage for heavy cornices and other boldly detailed simple moulded work.

"Special Hard" Gray and "Special Hard" Buff are grades that are specially adapted for base or grade courses, steps and platforms, buttresses, floor tiling, terrace paving, or any position in building subject to abrasion and constant wear under foot traffic, for which purposes these grades are recommended.

While Indiana Travertine constitutes only a very small percentage of the total output of the quarries and is sometimes considered as a waste product, the amount of selection required and the extra cost of working up this very distinctive material will generally make the price somewhat higher than for any of the regular grades. This stone is recommended chiefly for sawed ashlar and for sawed Facing or Ashlar slabs for interior work. When moulded, the detail should be kept plain and broad in treatment.

Both the Rustic Buff and the Travertine may be used—sawed either with or across the grain.

Standard Club, Chicago — Albert Kahn, Architect, Detroit, Mich.

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CUT INDIANA LIMESTONE.

1. Work Included:

The work under this contract shall include all labor and material for the furnishing of cut stone work in accordance with the drawings and as hereinafter specified.

2. Description of Stone.

All Limestone specified or shown on drawings shall be (state grade desired)
Select Gray,
[Often referred to as No. 1 Gray]
Standard Gray,
Select Buff,
[Often referred to as No. 1 Buff]
Standard Buff,
Variegated,

Indiana Oolitic Limestone building stock, free from all defects that would materially impair its strength, durability or appearance, and within the range of variation of color and texture represented by two samples approved by the Architect.

Specially graded stone, acceptable as to hardness and color as per samples to be submitted, shall be employed where indicated on drawings, for.....
and all other positions exposed to direct wear.

Wherever the terms "Indiana Limestone" or "Limestone" occur in this specification, they specifically refer to and shall imply "Indiana Oolitic Limestone" quarried in Lawrence County, Indiana, or Monroe County, Indiana.

3. Samples.

The contractor shall submit to the Architect, two samples which shall be typical of the extremes which the contractor proposes to furnish. Samples to be about 4" wide by 7" long by about 1" thick, with the large faces cut across the grain of the stone, with the finish specified indicated on the large face, and at least two of the edges to be rock faced. Similar samples shall be provided when Select stock or specially graded hard stone is specified for certain positions in the building.

These samples shall be labeled or otherwise clearly marked with the name of the contractor submitting same, the grade of the limestone, and with the statement: "Samples of Indiana Limestone to be furnished for the.....Building."

4. Standard Practice.

Insofar as these specifications pertain to the practice set out for the proper use of Indiana Oolitic Limestone, the standards established by the Indiana Limestone Quarrymen's Association, of Bedford, Indiana, are to govern. Bidders not familiar with these standards are cautioned to inform themselves regarding them.

The Architect reserves the right to approve the sub-contractor for Cut Stone before this portion of the work is awarded.

5. Cutting & Setting Drawings.

The cut stone contractor shall prepare and submit to the Architect for his approval complete cutting and setting drawings in triplicate for all of the Indiana Limestone work under this contract. Such drawings shall show in detail: sizes, sections and dimensions of stone. the arrangement of joints, bonding, anchoring and other necessary details.

Moulded or projecting courses, unless otherwise shown, shall have not less than four-sevenths (4/7) of their cubic contents inside the face of wall and all projecting stones, except where otherwise shown or specially anchored to the structure, and so provided for by details on setting drawings, shall have beds in the wall at least 1" greater in depth than their maximum projection. There shall be "through" or bond stones wherever indicated on approved stone details.

These drawings shall be based upon and follow the drawings and full size details prepared by the Architect, except where it is agreed in writing that changes be made. No departure from the Architect's drawings shall be indicated on setting drawings submitted to the Architect for approval unless this departure is specifically called to the Architect's attention by a letter of explanation accompanying same. Each stone indicated on these drawings shall bear a corresponding number marked on the back or bed with a non-staining paint.

Provision for the proper anchoring and dowelling or cramping of work in keeping with standard practices, also for the support of same by shelf angles and loose steel, etc., when required, shall be clearly indicated on the setting drawings.

6. Details for Lintels, Etc.

Lintels and Architraves or other members spanning openings, whether supporting a superimposed load or only their own weight, shall be of the proportions and sectional area that will provide an ample factor of safety based on the average ultimate breaking strength of the stone.

7. Carving & Models.

All carving shall be done under this contract by skilled carvers, in a correct and artistic manner, in strict accord with the spirit and intent of the Architect's sketches, or from plaster models prepared or approved by the Architect.

8. Cutting.

All stone shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on approved drawings. All exposed faces shall be cut true and out of wind. Beds and all joints shall be dressed straight and at right angles to the face unless otherwise shown, and except where otherwise shown or noted on drawings joints shall have a uniform thickness of ¼".

Patching or hiding of defects will not be permitted, and Lewis holes shall not be made on exposed surfaces.

Washes shall be as deep as practicable, and drips of sufficient width and depth to shed water shall be provided on all projecting stone and courses. In the absence of specific indication otherwise, all coping, caps and sills shall overhang the work below not less than 1½", and shall have ¾" drips.

Raglets for flashing, etc., shall be cut in the stone where so indicated on the drawings.

Moulded work shall be carefully executed from full size details supplied by the Architect, and must match perfectly at joints. All arrises shall be sharp and true.

All columns shall be accurately cut with entasis, as shown on drawings. All pilasters, unless indicated otherwise, shall be cut straight without entasis or taper.

9. Back-Checking & Fitting to Structural Frame.

Stone coming in connection with structural work shall be back-checked, as indicated on the general drawings. Stones resting on structural work shall have beds shaped to fit the supports.

Where stone facing adjoins steel columns and spandrel girders, the depth of stone shall be such that it will allow not less than three inches between extreme edge of metal and the back of the stone.

10. Finish.

The finish on exposed surfaces generally shall be smooth, machine dressed, showing no tool marks.

11. Lewis Holes & Cutting for Dowels, Anchors, Cramps, Etc.

Lewis holes shall be cut in all stones weighing more than 100 pounds. No Lewis or other holes shall come closer than 2 inches to the exposed face of the stone.

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Graham, Anderson, Probst & White, Architects, Chicago

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Holes and sinkages shall be cut in stones for all anchors, cramps, dowels, etc., called for under this specification or indicated on the cutting and setting drawings.

12. Loading & Shipment.

The Cut Indiana Limestone shall be carefully packed for rail or wagon transportation, with exercise of all customary practicable and reasonable precautions against damage in transit.

All cut stone under this contract shall be delivered promptly as ordered and in the sequence in which it is to be set.

13. Field Cutting.

(Specify in detail any field cutting that will be required.)

SETTING CUT STONE.

14. Work Included.

Contractor shall refer to the preceding specification for cut Indiana Limestone for more detailed information regarding the cut stone that is to be set under this contract; also refer to "General Masonry", "Sheet Metal Work", "Roofing" and "Carpentry" specifications for reference to work that must be executed in conjunction with this work.

15. Delivery & Storage.

All Indiana Limestone delivered f. o. b. cars at destination under another contract snall be carefully unloaded and delivered to the building site.

Wagon or truck haul shall be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or chipping in transit to and upon delivery at the building site.

The stone shall be stored at the building site, for whatever period, on planking set so that stone will rest entirely clear of the ground and be protected by proper means from damage to arrises and from contact with anything which would result in the accumulation of dirt, dust, soot, mud, grease or other staining or disfiguring elements. During extended periods of storage at building site, the stone shall be covered with tarpaulin, stout non-staining paper or boards.

16. Setting Mortar.

All Indiana Limestone shall be set in carefully prepared lime mortar tempered with stainless cement of an approved brand. The mixture shall consist of one part dry Hydrated Lime or lump lime paste, to not over three parts sharp, **washed clean** sand, with the addition of stainless cement in an amount equal to 15 per cent by volume of the lime used.

Lump Lime Paste shall be made of best quality freshly burned lump lime, slaked with cold water and screened through a three-sixteenths inch mesh screen into a settling box, following the practice employed in preparing lime for plastering, the Lime Putty so prepared to stand in the settling box not less than one week and then be mixed with the sand and be properly stacked to age. In each case proper precautions shall be taken by covering or otherwise absolutely to prevent either the lime or mortar from drying out. The cement shall be added and thoroughly worked into the mixture in small batches just prior to its use for the setting of the stone.

The sand must be washed clean, entirely free from silt, vegetable matter, salts and all other injurious substances, and must be screened if containing pebbles or very coarse grains that would interfere with the proper bedding and jointing of the work. The water must be clear and devoid of salts and all injurious chemical elements.

17. Scaffolding.

All scaffolding required for the proper execution of this work will be furnished and erected by the Masonry Contractor for the use of all mortar using trades.

18. Centering.

All wood centering required for the proper setting of Cut Stone work will be furnished and erected by the Carpentry Contractor.

19. Anchors & Dowels.

All anchors, dowels, cramps, Lewis anchors, etc., required by setting drawings or necessary for the proper erection of the work, shall be of thoroughly galvanized iron. Anchors, etc., to be galvanized after they have been bent to shape.

20. Setting Cut Stone.

The Indiana Limestone shall be set in accordance with the requirements of the drawings. When ready for setting, all stone shall be washed on ALL sides and, if required, be scrubbed clean with soap powder and water, applied with fibre brushes only, and be thoroughly rinsed with clean water. Immediately prior to setting, all stone shall again be sponged or drenched on all sides with clean water.

The stone shall be set accurately by competent stone setters, true to line and level, with full flushed joints, filling all anchor holes.

Wooden wedges may be used only where necessary to prevent the crushing of mortar under heavy blocks, and shall be thoroughly soaked before use.

Heavy projecting courses shall be securely propped until mortar has set and the wall above same is built.

All beds and vertical joints shall be of a maximum width of ¼ inch except where otherwise indicated. Mortar shall be raked out ¾ inch from the face of the stone to allow for pointing, and the stone be sponged off along all joints.

Splashing exposed faces of cut stone with mortar shall be avoided, and any splashing shall be immediately removed with a sponge and clean water.

The entire backs of all stone, while wet, shall be plastered with not less than ½ inch coat of setting mortar before backing up same, and where the stone occurs as a facing applied directly to previously erected structural members, both back of stone and face of structural work shall be plastered with setting mortar to insure a thoroughly filled back-joint.

The ends only of all sills shall be set in a full bed of mortar, balance of sills to be left free until pointed.

Steps shall be set with a slight pitch to the front.

All cornices, copings and projecting belt courses and all stones forming gutters, etc., shall be set with the vertical joints dry. These joints shall be caulked on exposed surfaces with picked oakum or rope yarn and shall then be filled solid from above with a mortar grout. Grout shall be composed of one part non-staining cement and one part fine white sand, mixed in small quantities, stirred vigorously until used, and of a consistency as thick as can be poured into joints.

Where the Limestone extends down to the grade line of the building, the first course above grade shall be placed on a layer of approved non-staining impervious material.

21. Backing Up Cut Stone.

The first course of brick next to stone facing, shall be laid in same kind of mortar as used by Masons for setting of stone.

22. Protection of Finished Work.

The Contractor setting Cut Stone shall cooperate with the Carpentry Contractor, who will furnish and erect the necessary protection for sills and projecting stone work.

23. Cleaning.

The face of all stone work under this contract shall be thoroughly cleaned upon completion, this cleaning to be done with soap powder boiled in clean water and applied vigorously with stiff fibre brushes. If necessary, clean, sharp, fine, white sand may be added to the soap and water mixture.

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After cleaning, the exposed surfaces are to be drenched with clear water.

The use of wire brushes or acids of any kind will not be permitted under any circumstances for cleaning the stone work.

24. Pointing.

All face joints shall be brushed out clean, ¾ inch in depth, carefully removing any wedges so that pointing will be continuous, and after a thorough wetting of the stone shall be pointed flush with mortar consisting of one part stainless cement, two parts clean white sand and sufficient cold lime putty to make as stiff a mixture as can be worked.

Notes on the Design of Structural Steel for skeleton frame buildings that are to be faced with stone.

It is really very important that more careful consideration be given to the requirements of the facing material in the preliminary layout of structural steel work than is often the case.

The facing material, along with the details of support for enclosure walls, is very often studied only after the size and position of columns, girders and main beams, including even the spandrel members, have been fixed. .This is not the best method of procedure, as a careful study of the Spandrel sections during the preliminary stages of design and layout of the structural frame will often result in considerable economy in the steel work.

Details for Spandrel sections should be carefully worked up in pencil during the early stages of preparing the small scale drawings, enabling them to be studied along with the Architectural features of the design and before the column centers and other lines have been definitely fixed, not afterwards, as these are the first items of information needed by the Structural Engineer in the detailing of the steel. This is also the case when the frame is of reinforced concrete.

The Spandrel sections should be kept as simple as possible, using self-supporting stone lintels wherever practicable and eliminating all unnecessary steel when an Indiana Limestone facing is to be used. A lot of small steel in the wall sections, angles, channels and loose lintel steel can frequently be omitted by a properly designed spandrel girder placed in the right position for the support of both facing and backing of enclosure of walls.

It must also be remembered that masonry, particularly Stone work, is decidedly more rigid than steel, and the steel work for the support of same should be designed with that in view. This may often mean that a single, deep, built-up plate-and-angle section is preferable to a plain rolled section or combination of shapes for spandrel members.

This does not necessarily involve a greater weight of metal for spandrel girders or lintel members supporting masonry of walls, but a different disposition of the material.

Any attempt to support the lintels or walls over wide openings with steel sections that will deflect appreciably under load, will usually occasion arch action in the masonry, preventing the steel from carrying the loads in the manner for which it was designed. This may cause excessive stresses in some portions of the masonry that may result in the crushing of mortar, opening of joints, and sometimes even the spalling or chipping off of corners or cracking of the stone.

On the other hand, too much steel in spandrel walls should be avoided; it is only necessary to have the supporting members so stiff that the steel frame will actually carry the load it is intended to carry without putting stress in the enclosure wall masonry. And another important point is so to detail the work that the Stone facing will not be pinched between supporting members of the structural frame when slight movements due to temperature changes occur.

There is also a tendency to place wall Columns too close to the face of wall, and it is usually advisable to fix the center line of these columns in a position that will permit the thickness of Stone Facing and one course of Brick work plus the proper allowance for joints between the outer face of steel and the normal face of wall in the shaft or main portion of building.

Placed in this position, the eccentric loading from walls can generally be balanced by the eccentric loading from floor girders, and this will usually permit the flanges for the regular plate-and-angle columns to be turned out towards face of wall, where they best serve for resisting wind stresses and for wind bracing connections, permitting the floor girder connections to be placed on the opposite flange of these columns.

And it is very important in the erection to be sure that the frame is carrying all of the enclosure wall load which it is intended to carry, and that this load is not being supported largely by the Facing through the deflection and settling to bearing of the steel work behind it. This may often mean that in tall buildings the erection of Stone Facing and Backing of enclosure walls should be started simultaneously at several different floor levels, and the entire enclosure walls of the shaft and upper portions of the building be completed before the Stone work of Base or lower stories is set.

It may not always be found practicable to do this, but the one point is to be sure that frame is carrying the full load of upper walls, particularly when there is an Arcade or Colonnade treatment of Stone work forming the base portion of a tall building, as Stone work of this character in lower portion can usually be made self-supporting for several stories in height, and for that reason steel should be kept out of it as far as practicable.

Stone Lintels should be made self-supporting whenever practicable. This is usually possible, even in paired or grouped windows, by the use of Stone Mullions, which give a better appearance and greater structural stability to any Stone design. This often simplifies the Spandrel Sections, making it necessary to support only the Spandrel Panels and sills on the structural frame.

Where Shelf Angles for Lintels must be used, it is often better to use loose Lintels than to have them rigidly connected to the structural frame, and where such connections are considered advisable, it is generally best to bracket or hang them from the Spandrel Girder with a slotted bolt connection that will permit of some adjustment, which is nearly always necessary to bring Steel Members of this character into the exact position for the support of Stone.

This also applies to outlook angles, which should never be rigidly connected but always fastened to the frame with a hooked or bolted connection over shim plates that will permit of adjustment into the exact position required for the support of projecting Stone work.

A little careful study given to details of this kind during the early stages of the Steel Design will usually result in the simplification of both the structural steel and the stone work, and facilitate the erection of both.

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Physical Properties of Indiana Limestone

As Developed by Tests Made at the Bureau of Standards, Washington, D. C., on 72 Specimens Of the Stone, Including All of the Grades Produced by the Indiana Limestone Quarry District in Lawrence and Monroe Counties, Indiana.

NOTE—The average values given below are the average of the various grades and are not the averages of all specimens tested; that is, they are not weighted averages.

⊥ to B:—indicates that the load was applied perpendicular to the bedding.

|| to B:—indicates that the load was applied parallel to the bedding.

GRADE	COMPRESSIVE STRENGTH				TRANSVERSE STRENGTH		Weight Per Cu. Ft. Dry	ABSORPTION PERCENTAGE		Apparent Specific Gravity	Porosity (Percentage Pore Space)
	DRY		WET								
	On Bed	On Edge	On Bed	On Edge	⊥ to B	‖ to B		By Wt.	By Vol.		
SELECT BUFF..... Statuary Stock.	6525	6320	6148	5931	1357	1021	140	5 52	12 32	2 24	17 72
SELECT BUFF.	7426	6743	6837	6290	1292	1022	144	4 75	11 14	2 30	15 47
STANDARD BUFF.....	6251	5455	6260	5458	1044	946	142	4 97	11 27	2 28	16 32
RUSTIC BUFF.....	5954	5333	5607	5089	1090	934	142	5 36	12 13	2 27	16 59
SELECT GRAY.....	8519	7121	7655	6781	1387	1107	145	4 26	9 86	2 32	14 75
STANDARD GRAY.....	7093	6061	6889	5951	1314	1272	147	4 28	9 87	2 35	13 70
*SELECT VARIEGATED .. See Note Below	7319	6328	6656	5792	1341	1167	144	4 76	10 82	2 31	15 21
*STANDARD VARIEGATED See Note Below	7962	6703	7642	6623	1277	1244	146	3 98	9 28	2 33	14 23
SPECIAL HARD GRADES	12769	13080	10417	10036	1614	1618	150	3 60	8 52	2 40	11 76
AVERAGE VALUES	7757	7016	7123	6139	1305	1148	144	4.60	10.58	2.31	15.08

*Since these tests were made, the segregation of the variegated stone into two grades has been abandoned under the Association Classification and there is now only one grade of "Variegated" stone.

The figures here given for weight, specific gravity, etc., being based upon this very comprehensive series of tests on the physical properties of Indiana Limestone, made by the Bureau of Standards, at Washington, D. C., are, therefore, true average figures of all of the grades. As above stated, the weight given is for the dry stone.

The average weight of a cubic foot of dry Indiana Limestone as here given is somewhat less than the figure given in previous publications of this Association, which were based upon older and less comprehensive data.

The average crushing values are also somewhat less, as the older tests were generally made on the harder grades of stone.

In figuring the weight of finished Cut Stone for shipment, cartage and other purposes, it is always taken at a higher weight on account of the presence of moisture in the form of quarry sap. It is customary to figure the weight at 150 pounds per cubic foot, but for loads in designing a structure, the lower actual average weight of 144 pounds per cubic foot for the dry stone should be taken.

The following list of "Dont's" embraces the more important items that should be avoided in the detailing, specifying, cutting and setting of Indiana Limestone:—

Don't cut up the design into too small units.

Don't joint columns and pilasters in small drums or sections when fewer units or monolithic shafts can be used.

Don't neglect proper provision for balancing or anchoring down on walls, all of the projecting Stone work.

Don't put too much structural Steel in Spandrel walls.

Don't use shelf angles for support of Stone Lintels when self-supporting Stone Lintels are practicable.

Don't complicate Spandrel Sections with a number of small Steel Members when one simple built-up section will suffice.

Don't check the beds to fit supporting steel; always place the steel lower and check the tops of Stone to fit around same.

Don't allow too little clearance between back of Stone and face of structural members.

Don't check out Stone to fit around steel or other structural Members, to the point of weakening its structural efficiency.

Don't require reprising and other such items involving additional cutting cost, on moderate cost work.

Don't specify too fine tooling.

Don't make rustication on ordinary work too deep.

Don't specify back-painting of Stone with Bituminous water-proofing preparations.

Don't specify Select Stone for all positions in a building.

Don't use ordinary expansion bolts for hanging of Stone.

Don't set Stone in Mortar containing ordinary Portland Cement, or permit the use of ordinary Portland Cement and most Natural Cements in Mortar for the setting of Backing in direct contact with Cut Stone.

Don't slab Stone against Concrete work without having first painted the back of Concrete with heavy coat of asphaltic Waterproofing Compound.

Don't use sand of questionable quality.

Don't neglect requiring the parging of backs of Stone with Lime Mortar where Lime Mortar is used and with non-staining Cement Mortar where that is used, when any different kind of Mortar is used for laying up of Backing.

Don't set dirty Stone or neglect the washing of same before setting.

Don't use Salt in water to lower freezing point of mortar.

Don't use Salt to thaw Ice on face of Cut Stone or to thaw Ice in Lewis and anchor holes.

Don't pile Stone in contact with ground or permit other materials to be piled in contact with stone.

Don't permit wash from Concrete floor construction or scaffolding above to run down onto walls during construction.

Don't permit unfinished walls to be exposed during inclement weather.

Don't permit oil or grease or compounds containing oils to come in contact with the Stone.

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NEW LUMBER STANDARDIZATION

SIMPLIFIED PRACTICE RECOMMENDATION ON LUMBER

In accordance with the unanimous action on December 12 to 13, 1923, and April 22, 1924, and May 1, 1925, of the general conferences of representatives of manufacturers, distributors, wholesalers, retailers, and users of lumber, and representatives of architects, engineers and general contractors, the United States Department of Commerce, through the Bureau of Standards, recommends that recognized nomenclature, basic grades, grade marking, sizes, and inspection of lumber be established as follows:

1. To the extent to which differences in quality of timber, in conditions of manufacture, and in the uses to which the product is put, will, in practical application, permit the basic provisions for the grading of lumber shall be uniform.

I. LUMBER CLASSIFICATIONS.

2. For the purposes of simplification of sizes and grades, and of equalizing, among species used for similar general purposes, the grades of a similar name, **lumber** shall be classified by principal uses into (a) yard lumber, (b) structural timbers, (c) shop or factory lumber.

Use Classification.

3. Lumber is the product of the saw and planing mill not further manufactured than by sawing, resawing, and passing lengthwise through a standard planing machine, crosscut to length and matched.

4. Lumber is classified as (a) yard lumber, (b) structural timbers, and (c) shop or factory lumber. Different grading rules may apply to each class of lumber.

(a) Yard Lumber: Lumber that is less than 6 inches in thickness and is intended for general building purposes. The grading of yard lumber is based upon the use of the entire piece.

(b) Structural Timbers: Lumber that is 6 inches or over in thickness and width. The grading of structural timbers is based upon the strength of the piece and the use of the entire piece.

(c) Shop or Factory Lumber: Lumber intended to be cut up for use in further manufacture. It is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a given minimum size and quality.

Size Classification.

2. Size Classification.

Yard Lumber.

5. **(a) Strips:** Yard lumber less than 2 inches thick and under 8 inches wide.

(b) Boards: Yard lumber less than 2 inches thick, 8 inches or over in width.

(c) Dimension: All yard lumber except boards, strips, and timbers; that is, yard lumber 2 inches and under 6 inches thick, and of any width.

(1) Planks: Yard lumber 2 inches and under 4 inches thick and 8 inches and over wide.

(2) Scantlings: Yard lumber 2 inches and under 6 inches thick and under 8 inches wide.

(3) Heavy Joists: Yard lumber 4 inches and under 6 inches thick and 8 inches or over wide.

Structural Timbers.

(d) Timbers: Lumber 6 inches or larger in least dimension.

3. Manufacturing Classification.

6. Manufactured lumber is classified as (a) rough, (b) surfaced, and (c) worked.

(a) Rough Lumber: Undressed as it comes from the saw.

(b) Surfaced Lumber: Lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E) or a combination of sides and edges (S1S1E), (S2S1E), or (S1S2E) or (S4S).

(c) Worked Lumber: Lumber which has been run through a matching machine, sticker, or molder. Worked lumber may be (1) matched, (2) shiplapped, or (3) patterned.

(1) Matched Lumber: Lumber that is edge dressed and shaped to make a close tongue and groove joint at the edges or ends when laid edge to edge or end to end.

(2) Shiplapped Lumber: Lumber that is edge dressed to make a close rabbetted or lap joint.

(3) Patterned Lumber: Worked lumber that is shaped to a patterned or molded form.

II. NOMENCLATURE OF COMMERCIAL SOFTWOODS.

7. The Standard Commercial Names for lumber cut from the principal species of softwoods, as shown in attached Appendix A, shall be used in the formulation of lumber grading rules and in the construction of contracts and the terms of purchase and sale of lumber thereunder.

III. YARD LUMBER.

8. The term "yard lumber" as here used means lumber that is manufactured and classified into those sizes, shapes, and qualities required for ordinary construction and general purpose uses. (Heavy timbers for structural purposes, softwood factory lumber, hardwood factory lumber, and other special-use materials are not considered yard stock.)

1. Grade Standards.

9. On the basis of quality yard lumber is divided into two main divisions: (a) Select lumber and (b) common lumber. These are again divided into two classes—Select lumber into (1) that suitable for natural finishes and (2) that suitable for paint finishes. Common lumber into (1) that which can be used without waste and (2) that which permits some waste. Each of these four classes is further divided into quality classes or grades.

Select Lumber.

10. Lumber which is generally clear, containing defects limited both as to size and number, and which is smoothly finished and suitable for use as a whole for finishing purposes or other uses in which large, clear pieces are required, shall be considered as **select lumber.**

11. Two classes shall be recognized. The first shall be suitable for natural finishes. The second class permits similar defects, and in addition, blemishes of somewhat greater extent than those of the first class, but of a type which can be covered by paint.

Grade names: A, B, C, and D.

Common Lumber.

12. Lumber containing numerous defects and blemishes which preclude it from use for finishing purposes, but which is suitable for general utility and construction purposes, shall be considered **common lumber.**

13. Two general classes shall be recognized. The first shall be suitable for use as a whole for purposes in which surface covering or strength is required. Defects and blemishes permitted in this class must be sound. The second class permits very coarse defects which may cause waste in the use of the piece.

Grade names: No. 1 Common, No. 2 Common, No. 3 Common, No. 4 Common, and No. 5 Common.

Dimension grade names: No. 1 Common, No. 2 Common, and No. 3 Common.

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14. **Summary of Basic Grade Classification for Yard Lumber.**

Total products of a typical log arranged in series according to quality as determined by appearance.

- SELECT. Lumber of good appearance and finishing qualities.
  - Suitable for natural finishes.
    - Grade A—Practically free from defects.
    - Grade B—Allows a few small defects or blemishes.
  - Suitable for paint finishes.
    - Grade C—Allows a limited number of small defects or blemishes that can be covered with paint.
    - Grade D—Allows any number of defects or blemishes which do not detract from a finish appearance, especially when painted.
- COMMON. Lumber containing defects or blemishes which detract from a finish appearance but which is suitable for general utility and construction purposes.
  - Lumber suitable for use without waste.
    - No. 1 Common—Sound and tight knotted stock. Size of defects and blemishes limited. May be considered water-tight lumber.
    - No. 2 Common—Allows large and coarse defects. May be considered grain-tight lumber.
  - Lumber permitting waste.
    - No. 3 Common—Allows larger and coarser defects than No. 2 and occasional knot holes.
    - No. 4 Common—Low quality lumber admitting the coarsest defects such as rot and holes.
    - No. 5 Common—Must hold together under ordinary handling.

Definitions of Defects and Blemishes.

15. The defects and blemishes, enumerated in the rules for grading yard lumber of any species under the American Lumber Standards, shall be defined within the limits of the "Definitions of Maximum Defects and Blemishes" as shown in attached Appendix B.

General Provisions.

16. The grading of lumber cannot be considered an exact science, because it is based on a visual inspection of each piece and on the judgment of the grader. The provisions of the see specifications, however, are sufficiently explicit to establish 5 per cent below grade as a reasonable variation between graders.

17. Except in dimension, the grade of yard lumber, rough or surfaced two sides, shall be determined from the better or face side of the piece, and lumber which is surfaced one side only shall be graded from the surfaced side.

18. The rules for yard lumber prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissable in each grade.

19. The number of defects and blemishes permitted varies as the area of the piece to be graded increases or diminishes in respect to the standard size specified, but the size of the defects must not exceed that allowed by the grading rules.

20. When defects or blemishes, or combinations thereof, not described in these grading rules are ecountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

21. Material shall be considered vertical grain when the rings (so-called grain) form an angle of 45° or more with the surface of the piece. When the angle becomes less than 45° at any point, the material shall be known as flat (slash) grain.

22. Mixed grades other than the two highest recognized grades for each species, not specifying the proportion of each grade, are not American Standard grades.

2. Size Standards.

Dressed Sizes.

23. The terms "standard board and extra standard boards" and "standard dimension and extra standard dimension" shall be the designations for 1-inch boards (yard) and 2-inch dimension (yard), respectively, and applied to both softwoods and hardwoods.

24. $\frac{25}{32}$ inch, S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species), shall be the thickness for the standard yard board; $\frac{26}{32}$ inch, S1S or S2S, for the extra standard yard board.

25. $1\frac{5}{8}$ inches, S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species), shall be the thickness for standard dimension not more than 12 inches wide; $1\frac{3}{4}$ inches, S1S or S2S, for extra standard dimension.

26. The finished widths of boards, dimension and finish S1E or S2E (measured at standard commercially dry shipping weight and moisture content for each species) shall be $\frac{3}{8}$ inch off on lumber of standard widths less than 8 inches and $\frac{1}{2}$ inch off on lumber of standard widths of 8 inches and over.

27. The thicknesses and widths of finished lumber, S1S or S2S, and/or S1E or S2E, shall be as follows:

Tables of sizes, methods of lumber measurement, shipping and other provisions included in the recommendations of December, 1923 and amended May 1, 1925, are not republished.

Rough Dry Sizes.

28. The standard rough dry thickness of the standard board shall be not less than $\frac{53}{64}$ inch with an allowance of 20 per cent of the shipment, which may be not less than $\frac{28}{32}$ inch, and the standard rough dry thickness of the extra standard board shall be not less than $\frac{30}{32}$ inch with an allowance of 10 per cent of the shipment, which may be not less than $\frac{53}{64}$ inch.

29. The standard rough dry thickness of finish common boards, and dimension of standard sizes $1\frac{1}{4}$ inches and thicker, board measure, shall be not less than $\frac{1}{8}$ inch thicker than the corresponding standard finished dry thickness, with an allowance of 20 per cent of the shipment, which may be not less than $\frac{3}{32}$ inch thicker than the corresponding standard finished dry thickness.

30. The widths of finish, common boards, and dimensions, rough and commercially dry, 7 inches and narrower, shall be not more than $\frac{1}{4}$ inch less than the nominal widths, and the widths 8 to 12 inches board measure shall be not more than $\frac{3}{8}$ inch less than the nominal widths.

LENGTHS.

31. With the exception of the following enumerated odd lengths, which shall be standard, odd lengths in yard lumber be not considered in American Lumber Standards.

2 by 4 inches, 6 and 8 inches—9 and 11 feet.

2 by 8 inches and 10 inches—13 feet.

2 by 10 inches—15 feet.

8 by 8 inches, 10 by 10 inches, 10 by 12 inches, 12 by 12 inches, 14 by 14 inches, 16 by 16 inches, 18 by 18 inches—11 and 13 feet.

6 by 16 inches, 6 by 18 inches, 8 by 16 inches, 8 by 18 inches—15 and 17 feet.

32. Between the dates of May 1, 1925, and May 1, 1926, the percentage of short lengths eligible to inclusion in shipments of random lengths remain as provided in present practice.

APPENDIX A

STANDARD COMMERCIAL NAMES FOR LUMBER CUT FROM THE PRINCIPAL SPECIES OF SOFTWOODS.

The following Standard Commercial Names for lumber cut from the principal species of softwoods shall be used in the construction

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of contracts and other documents arising in transactions of purchase and sale of American Standard lumber. Preferred commercial names are shown in **bold face type.**

Standard Commercial Name	Botanical Name
Cedars	
Alaska Cedar	Chamaecyparis nootkatensis
Eastern Red Cedar	Juniperus virginiana
Incense Cedar	Libocedrus decurrens
Northern White Cedar	Thuja occidentalis
Port Orford Cedar	Chamaecyparis lawsoniana
Southern White Cedar	Chamaecyparis thyoides
Western Red Cedar	Thuja plicata
Cypress	
Southern Cypress	Taxodium distichum
Red Cypress	Taxodium distichum
Yellow Cypress	Taxodium distichum
White Cypress	Taxodium distichum
Douglas Fir	
Douglas Fir	Pseudotsuga taxifolia (Coast type)
Red Fir	Pseudotsuga taxifolia (Intermountain type)
The True Firs	
Alpine Fir	Abies lasiocarpa
Balsam Fir	Abies balsamea and Abies fraseri (southern balsam fir)
Golden Fir	Abies magnifica
Noble Fir	Abies nobilis
Silver Fir	Abies amabilis
White Fir	Abies concolor and Abies grandis (lowland white fir)
Hemlocks	
Eastern Hemlock	Tsuga canadensis
Mountain Hemlock	Tsuga mertensiana
West Coast Hemlock	Tsuga heterophylla
Larch (See also Tamarack)	
Western Larch	Larix occidentalis
Pines	
Arkansas Soft Pine	Pinus echinata and taeda
California White Pine	Pinus ponderosa and Pinus jeffreyi (Jeffrey pine)
Idaho White Pine	Pinus Monticola
Jack Pine	Pinus divaricata
Loblolly Pine	Pinus taeda
Lodgepole Pine	Pinus contorta
Longleaf Pine	Pinus palustris
North Carolina Pine	Pinus taeda and echinata, and Pinus Virginiana (Virginia Pine).
Northern White Pine	Pinus strobus
Norway Pine	Pinus resinosa
Pond Pine	Pinus serotina
Pondosa Pine	Pinus ponderosa
Shortleaf Pine	Pinus echinata
Slash Pine	Pinus caribaea
Southern Pine or Southern Yellow Pine.	Pinus taeda, palustris, serotina, echinata, and caribaea, and Pinus rigida, (pitch pine), and Pinus glabra (spruce pine)
Sugar Pine	Pinus lambertiana
Redwood	
Redwood	Sequoia sempervirens
Spruces	
Eastern Spruce	Picea mariana (black spruce), Picea rubra (red spruce), and Picea glauca (white spruce)
Engelmann Spruce	Picea engelmanni and Picea parryana (blue spruce)
Sitka Spruce	Picea sitchensis
Tamarack	
Tamarack	Larix laricina

APPENDIX B

DEFINITIONS OF MAXIMUM DEFECTS AND BLEMISHES

1. A **defect** is defined as any irregularity occurring in or on wood that may lower some of its strength, durability, or utility values.

2. A **blemish** is defined as anything, not classified as a defect, marring the appearance of the wood.

The commonly recognized defects and blemishes occurring in..... .....yard lumber are (names of species manufactured)

Bark pockets.	Pitch.
Bird's-eye.	Pitch pockets.
Checks.	Pitch seams.
Cross-breaks.	Pitch streaks.
Cross-grain.	Pith.
Decay.	Pith flecks.
Gum spots or streaks.	Shake.
Holes.	Splits.
Imperfect manufacture.	Stain or discoloration.
Knots.	Wane.
	Warp.

Bark Pockets.

3. A **bark pocket** is a patch of bark partially or wholly enclosed in the wood. In size it is classified the same as pitch pockets.

Bird's-eye.

4. **"Bird's-eye"** is a small central spot with the wood fibres arranged around it in the form of an ellipse, so as to give the appearance of an eye. "Bird's-eye," unless unsound or hollow, shall not be considered a defect.

Checks.

5. A **check** is a lengthwise separation of the wood, which occurs usually across the rings of annual growth.

6. A **surface check** is a check occurring on the surface of the piece.

7. A **small surface check** is a perceptible opening not over 4 inches long.

8. A **medium surface check** is one not over $\frac{1}{32}$ inch wide and over 4 but not more than 10 inches long.

9. A **large surface check** is one over $\frac{1}{32}$ inch wide and over 10 inches long.

10. An **end check** is one occurring on an end of a piece.

11. A **through check** is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

12. A **heart check** is one starting at the pith and extending toward but not to the surface of a piece.

Cross Breaks.

13. A **cross break** is a separation of the wood cells across the grain, such as may be due to tension resulting from unequal shrinkage or mechanical stresses.

Cross Grain.

14. **Cross grained** wood is that in which the cells or fibres do not run parallel with the axis, or sides, of a piece.

15. **Slight cross grain** is a slope of the grain not over 1 inch in a length of 15 inches.

16. **Medium cross grain** is a slope of the grain over 1 inch in a length of 15 inches but not more than 1 inch in a length of 10 inches.

17. **Steep cross grain** is a slope of the grain over 1 inch in a length of 10 inches.

Decay.

18. **Decay** is a disintegration of the wood substance due to the action of wood-destroying fungi. The words dote and rot mean the same as decay.

19. **Incipient decay** is the early stage of decay in which the disintegration has not proceeded far enough to soften or otherwise change the hardness of the wood perceptibly.

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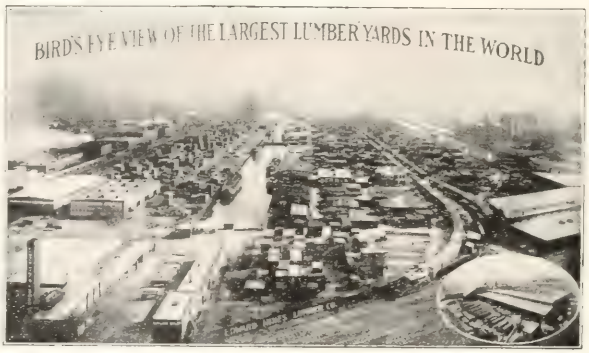

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It is usually accompanied by a slight discoloration or bleaching of the wood.

20. **Firm red heart** is a stage of incipient decay characterized by a reddish color produced in the heartwood, which does not unfit the wood for the majority of yard purposes.

21. **Water-soak (or stain)** is a term applied to a generally water-soaked area in heartwood, which is usually interpreted as the incipient stage of certain wood rots.

22. **Advanced (or typical) decay** is the older stage of decay in which the disintegration is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

23. A **pocket rot** is typical decay which appears in the form of a hole, pocket, or area of soft rot, usually surounded by apparently sound wood.

Gum Spots and Streaks.

24. A **gum spot** or **streak** is an accumulation of gum-like substance occurring as a small patch or streak in a piece. It may occur in conjunction with a bird peck, or other injury to the growing wood. In size they are classified the same as pitch pockets or pitch streaks.

Holes.

25. **Holes** in wood may extend partially or entirely through the piece and be from any cause.

26. When **holes** are permitted, the average of the maximum and minimum diameters measured at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

27. A **pin worm hole** is one not over $\frac{1}{16}$ inch in diameter.

28. A **medium worm hole** is one over $\frac{1}{16}$ inch but not more than $\frac{1}{4}$ inch in diameter.

29. A **large worm hole** is one over $\frac{1}{4}$ inch in diameter.

Imperfect Manufacture.

30. **Imperfect manufacture** includes all defects or blemishes which are produced in manufacturing, such as chipped grain, loosened grain, raised grain, torn grain, skips in dressing, hit and miss, variation in sawing, miscut lumber, machine burn, machine gouge, mismatching, and insufficient tongue or groove.

31. **Chipped grain** means that a part of the surface is chipped or broken out in very short particles below the line of cut. It should not be classed as torn grain and, as usually found, shall not be considered a defect, unless it is present in excess of 25 per cent of the area.

32. **Loosened grain** means that a small portion of the wood has become loosened but not displaced.

33. **Raised grain** is a roughened condition of the surface of dressed lumber in which the hard summerwood is raised above the softer springwood, but not torn loose from it.

34. **Torn grain** means that a part of the wood is torn out in dressing, and in depth is of four distinct characters; slight, medium, heavy, and deep.

35. **Slight torn grain** is not over $\frac{1}{32}$ inch in depth.

36. **Medium torn grain** is over $\frac{1}{32}$ but not more than $\frac{1}{16}$ inch in depth.

37. **Heavy torn grain** is over $\frac{1}{16}$ but not more than $\frac{1}{8}$ inch in depth.

38. **Deep torn grain** is over $\frac{1}{8}$ inch in depth.

39. A **skip** is an area on a piece that failed to surface.

40. A **slight skip** is one that failed to surface smoothly, whose area does not exceed the product of the width of the piece in inches multiplied by 6.

41. A **heavy skip** is one that the planer knife did not touch.

42. **Hit and miss** is a series of skipped spots with surfaced areas between, or with skips the entire length when not over $\frac{1}{16}$ inch in depth.

43. **Variation in sawing** is a deviation from the line of cut. Slight variation is not more than $\frac{1}{16}$ inch in one-inch material, $\frac{1}{8}$ inch in 2-inch, $\frac{3}{16}$ inch in 3 to 7-inch, and $\frac{1}{4}$ inch in 8 inches and up.

44. **Miscut lumber** is that which has a greater variation in thickness or width at different places on the piece than specified for variation in sawing.

45. A **machine burn** is a darkening or charring of the wood due to overheating by the machine knives.

46. A **machine gouge** is a groove across a piece due to the machine cutting below the desired line of cut.

47. **Mismated material** is worked material that does not fit tightly at all points of contact between adjoining pieces, or in which the surfaces of adjoining pieces are not in the same plane.

48. **Slight mismatch** is a surface variation not over $\frac{1}{64}$ inch.

49. **Medium mismatch** is a surface variation over $\frac{1}{64}$ but not more than $\frac{1}{32}$ inch.

50. **Heavy mismatch** is a surface variation over $\frac{1}{32}$ inch.

Knots.

51. A **knot** is a branch or limb embedded in the tree which has been cut through in the process of lumber manufacture. Knots are classified according to size, form, quality, and occurrence.

52. The average of the maximum and minimum diameters shall be used in measuring the size of knots, unless otherwise stated.

Size.

53. A **pin knot** is one not over $\frac{1}{2}$ inch in diameter.

54. A **small knot** is one over $\frac{1}{2}$ inch but not more than $\frac{3}{4}$ inch in diameter.

55. A **medium** knot is one over $\frac{3}{4}$ inch but not more than $1\frac{1}{2}$ inches in diameter.

56. A **large knot** is one over $1\frac{1}{2}$ inches in diameter.

Form.

57. A **round knot** is one oval or circular in form.

58. A **spike knot** is a branch or limb sawed in a lengthwise direction.

Quality.

59. A **sound knot** is solid across its face, as hard as the surrounding wood, and shows no indications of decay. It may vary in color from red to black.

60. An **unsound knot** is solid across its face, but contains incipient decay.

61. A **decayed knot** is softer than the surrounding wood and contains advanced decay.

62. A **tight knot** is one so fixed by growth or position that it will firmly retain its place in the piece.

63. An **intergrown knot** is one whose rings of annual growth are completely intergrown with those of the surrounding wood.

64. A **watertight knot** is one whose rings of annual growth are completely intergrown with those of the surrounding wood on one surface of the piece, and which is sound on that surface.

(Note: Definitions for sound, tight, intergrown, or watertight knots may be combined in one or more definitions.)

65. An **encased knot** is one whose rings of annual growth are not intergrown and homogeneous with those of the surrounding wood. The encasement may be partial or complete; or pitch or bark.

66. A **"not firm" knot** is one which under ordinary conditions will hold its place in a dry board and yet under pressure can be started but not easily pushed out of the piece.

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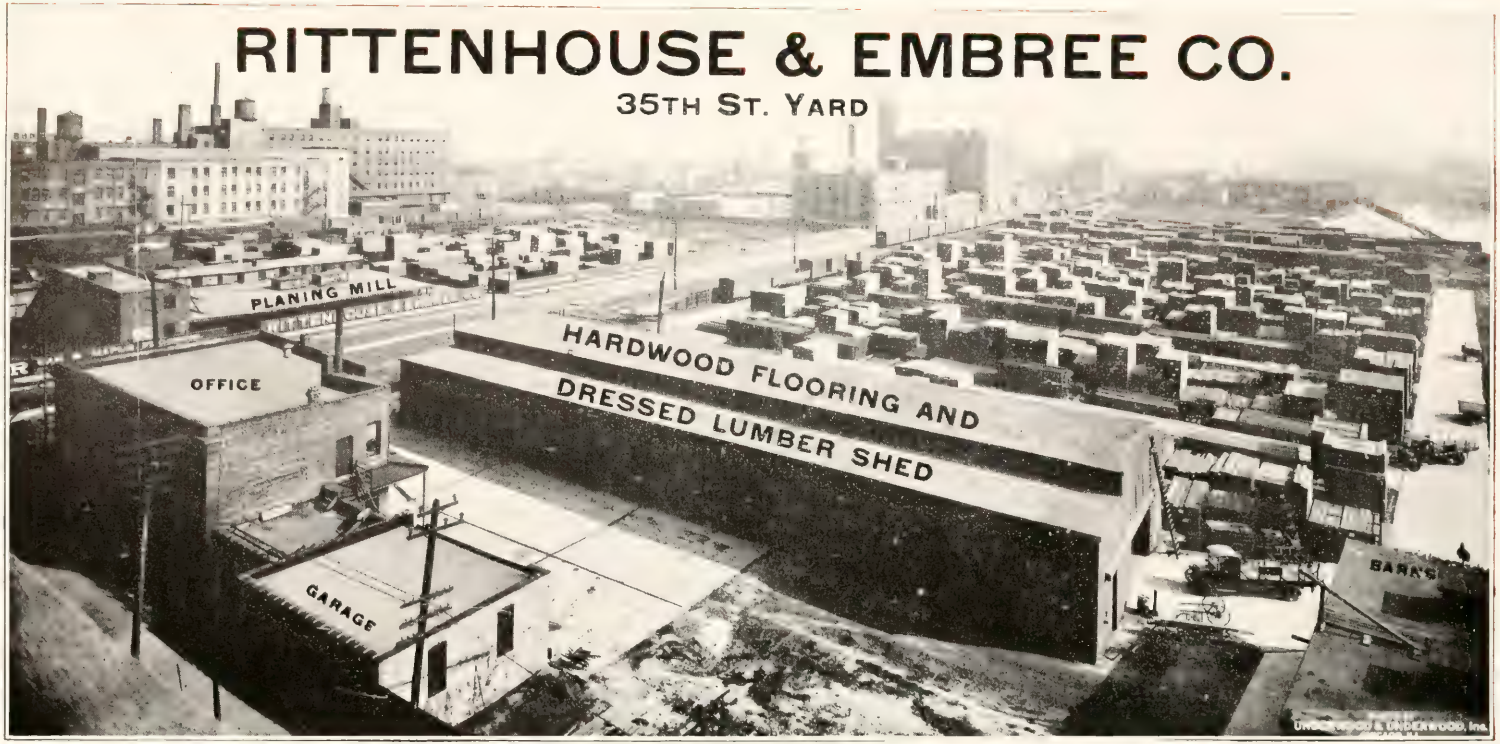

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67. A **loose knot** is one not held firmly in place by growth or position and cannot be relied upon to remain in place in the board.

68. A **pith knot** is a sound knot with a pith hole not more than 1/4 inch in diameter.

69. A **hollow knot** is an apparently sound knot with a relatively large hole in it.

Occurrence

70. A **single knot** is one occurring by itself with the fibers of the wood in which it occurs deflected around it.

71. A **knot cluster** is two or more knots grouped together as a unit with the fibres of the wood deflected around the entire unit. A group of single knots is not a knot cluster.

72. **Branch knots** are two or more knots branching from a common center.

Pitch.

73. **Pitch** is a poorly defined accumulation of resin in the wood cells in a more or less irregular patch.

74. **Light pitch** is the lightly evident presence of pitch.

75. **Medium pitch** is a slightly more evident trace of pitch than is the light.

76. **Heavy pitch** is the very evident presence of pitch showing by its color and consistency.

77. **Massed pitch** is a clearly defined accumulation of solid pitch in a body by itself in a piece of lumber.

Pitch Pockets.

78. A **pitch pocket** is a well defined opening between rings of annual growth usually containing, or which has contained, more or less pitch, either solid or liquid. Bark also may be present in the pocket.

79. A **very small pitch pocket** is one not over 1/8 inch in width and not over 2 inches in length.

80. A **small pitch pocket** is one not over 1/8 inch in width and not over 4 inches in length, or not over 1/4 inch in width and not over 2 inches in length.

81. A **medium pitch pocket** is one not over 1/8 inch in width and not over 8 inches in length, or not over 3/8 inch in width and not over 4 inches in length.

82. A **large pitch pocket** is one whose width or length exceeds the maximum stated as permissible for a medium pitch pocket.

83. A **closed pitch pocket** is one that does not show an opening on both sides of the piece.

Pitch Seams.

84. A **pitch seam** is a shake or check which is filled with pitch.

Pitch Streaks

85. A **pitch streak** is a well-defined accumulation of pitch in a more or less regular streak.

86. A **small pitch streak** is one not over 1/12 the width by 1/6 the length of the surface on which it occurs.

87. A **medium pitch streak** is one over 1/12 but not more than 1/6 the width, by over 1/6 but not more than 1/3 the length of the surface on which it occurs.

88. A **large pitch streak** is over 1/6 the width by 1/3 the length of the surface on which it occurs.

Pith.

89. **Pith** is the small soft core occurring in the structural center of a log. The wood immediately surrounding the pith often contains small checks, shake, or numerous pin knots, and is discolored; any such combination of defects and blemishes is known as **heart center.**

Pith Flecks.

90. A **pith fleck** is a narrow streak resembling pith, usually brownish, up to several inches in length on the surface of a piece resulting from burrowing of larvae in the growing tissue of the tree.

Shake.

91. A **shake** is a lengthwise separation of the wood, which occurs usually between and parallel to the rings of annual growth.

92. A **fine shake** is one with a barely perceptible opening.

93. A **slight shake** is one with more than a perceptible opening but not over 3/32 inch in width.

94. A **medium shake** is one with an opening over 3/32 but not more than 1/8 inch wide.

95. An **open shake** is one with an opening over 1/8 inch wide.

96. A **through shake** is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

Splits.

97. A **split** is a lengthwise separation of the wood, due to the tearing apart of the wood cells.

98. A **short split** is one whose length does not exceed either the width of a piece or 1/6 its length.

99. A **medium split** is one whose length exceeds the width of a piece, but does not exceed 1/6 its length.

100. A **long split** is one whose length exceeds 1/6 the length of a piece.

Stain (or Discoloration).

101. **Stain** is a discoloration, occurring on or in lumber, of any color other than the natural color of the piece on which it appears. It is classified as light, medium, and heavy.

102. **Light stain** is a slight difference in color which will not materially impair the appearance of the piece if given a natural finish.

103. **Medium stain** is a pronounced difference in color which, although it does not obscure the grain of the wood, would customariiy be objectionable in a natural but not in a painted finish.

104. **Heavy stain** is a difference in color so pronounced as practically to obscure the grain of the wood.

Wane.

105. **Wane** is bark, or the lack of wood or bark, from any cause, on the edge or corner of a piece.

106. **Slight wane** is not over 1/4 inch wide on the surface on which it appears, for 1/6 the length and 1/4 the thickness of the piece.

107. **Medium wane** is over 1/4 inch but not more than 1/2 inch wide on the surface on which it appears, for 1/6 the length and 1/4 the thickness of the piece.

108. **Large wane** is over 1/2 inch wide on the surface on which it appears, and/or over 1/6 the length and 1/4 the thickness of the piece.

Warp.

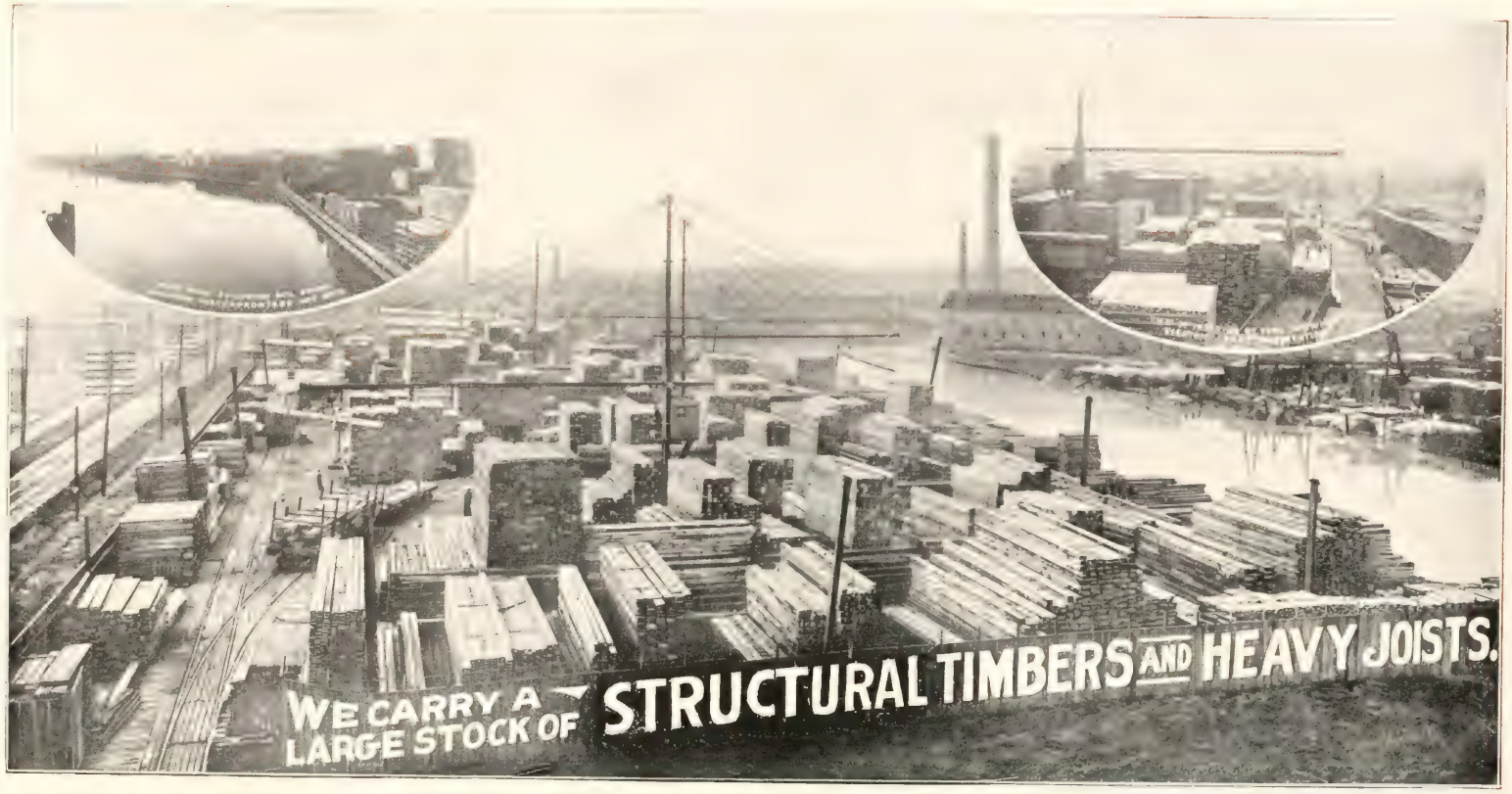
109. **Warp** is any variation from a true or plane surface. It includes bow, crook, cup, or any combination thereof.

110. **Bow** is a deviation flatwise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line.

111. **Crook** is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line. It is known as slight, small, medium, and large.

112. Based on a piece 4 inches wide and 16 feet long, the distances for the different degrees of crook shall be: for **slight crook,** a maximum of 1 inch; **small crook,** 1 1/2 inches; **medium crook,** 3 inches; and **large crook,** over 3 inches. For wider pieces it shall be 1/8 inch less for each additional 2 inches of width. Shorter or longer pieces may have the same curvature.

113. **Cup** is a curve in a piece across the grain or width of a piece. It is measured at the point of greatest deviation from a straight line drawn from edge to edge of a



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piece. It is known as slight, medium, and deep.

114. Based on a piece 12 inches wide, the distances for the different degrees of cup shall be: for **slight cup,** a maximum of 1/4 inch; **medium cup,** 3/8 inch; and **deep cup,** 1/2 inch. Narrower or wider pieces may have the same curvature.

STANDARD LUMBER GRADES.

The standard grades of yard stock products, such as flooring and siding, will conform to the basic grading specifications, with such modifications as are required by the use intended or may be permitted in the interests of conservation. Grades other than these described shall be considered special.

(These grades are based on a piece 8 inches wide by 12 feet long, or a piece which contains 8 square feet, surface measure.)

GRADE A shall be free from defects on the face side of pieces to and including 12 inches in width. Widths greater than 12 inches will admit two or combination of two of any of the following defects:

Sound and tight pin knot.
Small pitch pocket.
Small surface check.
Slight crook.
Slight wane.

GRADE B shall possess natural finishing qualities but will admit two or combination of two of any of the following defects:

Medium sound and intergrown knot.
Two small knots.
Three sound and tight pin knots.
Short split.
Fine shakes; equal in length to width of piece.
Three small surface checks.
Medium wane.
Small crook.
Slight cup.
Medium pitch pocket.
Three very small pitch pockets.
Small pitch streak.
Pin worm holes, one per surface foot.
Slight discoloration; 5 per cent of area.
Firm red heart; 5 per cent of area.
Patch slight torn grain.
Slight chipped grain.

GRADE C shall possess finishing qualities but will admit any four or combination of four of any of the following defects:

Medium sound and intergrown knot.
Small encased knot.
Three sound and tight pin knots.
Short split.
Fine shake; equal in length to width of piece.
Three small surface checks.
Medium wane.
Small crook.
Slight cup.
Medium pitch pocket.
Three very small pitch pockets.
Medium pitch streak.
Pin worm holes; 2 per surface foot.
Medium discolorations: 10 per cent of area.
Firm red heart; 10 per cent of area.
Pith. 3 inches in length.
Patch medium torn grain.
Slight skip.

GRADE D shall be of select common quality and possess a finishing appearance but will admit any number of the following defects and blemishes. More serious defects shall be permitted on the reverse side, but no combination so serious as to prevent its use for the purpose intended.

Medium sound and intergrown knot.
Small encased knot.
Short split.
Fine shake.
Medium surface check.
Medium wane.
Small crook.
Slight cup.
Medium pitch pocket.
Medium pitch streak.
Pin worm holes; 2 per surface foot.
Medium discoloration: 10 per cent of area.
Firm red heart: 10 per cent of area.
Pith. 3 inches in length.
Patch medium torn grain.
Slight skip.

Pieces containing one serious defect, such as loose knot or knot hole located more than 32 inches from either end, but which may be cut out with a loss no greater than 3 inches in length, may be permitted, provided the rest of the piece is of B or better quality.

No. 1 Common shall present a generally smooth appearance and be high class general utility lumber. It permits any number of the following defects not in serious combination:

Sound and intergrown knots: 1½ inches in diameter in 4-inch and 6-inch widths, 2 inches in 8-inch and 10-inch, 2½ inches in 12-inch and not over 3 inches in wider widths.

Black and encased knots: one-half the diameter of sound and intergrown knots permitted up to a maximum diameter of 1¼ inches, provided the knot be sound and immovably fixed in position.

Short split.
Slight shake that does not go through; equal in length to width of piece.
Surface checks.
Medium wane.
Small crook.
Medium cup.
Large pitch pockets which do not show an opening through the piece.
Large pitch streak.
Pitch.
Pin worm holes not exceeding 12 per surface foot if well scattered.
Medium discoloration.
Firm red heart.
Pith one-sixth the length of piece.
Patch heavy torn grain.
Slight skip.
Medium cross grain.

No. 2 Common permits any number of the following defects, but no combination of them so serious as to prevent the use of each piece as a whole, except as noted:

Sound and tight knots: 2½ inches in diameter in 4 and 6-inch widths, 3 inches in 8 and 10-inch, 3½ inches in 12-inch, and not over 4 inches in wider widths.
Unsound and pith knots, provided the knot be fixed in position.
Spike or branch knots; which are sound and do not weaken the piece at any point more than the knots heretofore specified.
Splits not more than ¼ the length of the piece.
Through check or shake; ½ the length of the piece.
Large wane.
Medium crook.
Large cup.
Large through pitch pockets; which do not show an opening greater than ⅛ inch wide by 3 inches in length.
Large pitch streak.
Pitch.
Small grub worm holes; maximum of one per surface foot.
Pin worm holes.
Slight peck.
Heavy discoloration.
Firm red heart.
Streak of advanced decay, not going through the board, equal in area to a streak ½ inch wide by 1/6 the length of piece.
Pith.
Deep torn grain.
Slight skips.
Large cross grain.
Pieces containing a loose knot or a knot hole not more than 2 inches in diameter may be permitted, provided the rest of the piece is of No. 1 Common quality.

No. 3 Common permits all defects and blemishes allowed in No. 2 Common but to a greater degree. It shall be suitable for use as a whole.

No. 4 Common. The defects common to this grade are much the same as those found in No. 3, but exist to a greater degree. The most common serious defects are knot holes,

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either red rot or its equivalent, in heavy massed pitch, or serious check. Other types are extremely coarse knotted, waney, excessive heart shake, badly split or badly checked pieces.

No. 5 Common is the lowest recognized grade and admits all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

GRADE RULES FOR SOUTHERN PINE LUMBER

To Conform To

AMERICAN LUMBER STANDARDS FOR YARD LUMBER.

GENERAL INSTRUCTIONS.

1. Southern Pine Yard lumber shall be graded and classified according to the following rules and specifications as to quality, and dressed stock shall conform to the subjoined tables of American Lumber Standard sizes—EXCEPT WHERE OTHERWISE EXPRESSLY STIPULATED BETWEEN BUYER AND SELLER.

DEFINITION OF DEFECTS.

2. The following definitions of defects are Southern Pine Association standards and are used in these specifications.

3. A defect is any irregularity occurring in or on wood that may lower some of its strength, durability, or utility values.

4. The commonly recognized defects occurring in Southern Pine Lumber are: Checks, Decay, Holes, Imperfect Manufacture, Knots, Pitchpockets, Pitch, Pitch Streaks, Pith, Shakes, Splits, Stain, Wane, Warp.

The following constitute Southern Pine Association specification variations from definitions found in Appendix B of American Lumber Standards, and several minor changes from American Lumber Standards. It may be noted that these variations adjust the provisions in American Lumber Standards to the conditions surrounding the growth and manufacture of Southern Pine, and in general tend to improve grades and clarify the application of rules for defects.

Paragraph 22, Appendix B, Paragraph 10
S. P. A. omits:

"Decided discoloration or bleaching of the rotted wood is often apparent" but adds "Unsound red heart (honey combed) is a typical example of advanced decay."

Paragraph 20, Appendix B, Paragraph 11
S. P. A. reads:

"Firm red heart is characterized by a reddish or brown color in the wood. It does not unfit wood for the majority of yard purposes and is not considered a defect in any of the grades of common lumber, and is only restricted in the higher grades as hereinafter specified."

Paragraph 40, Appendix B, Paragraph 26
S. P. A. reads:

"Multiplied by 3."

Paragraph 55, Appendix B, Paragraph 34
S. P. A. reads:

"A standard knot."

Paragraph 59, Appendix B, Paragraph 38
S. P. A. adds:

"And is so fixed by growth or position that it will retain its place in the piece."

Paragraph 65, Appendix B, Paragraph 41,
S. P. A. adds:

"If intergrown partially, or is so fixed by growth or position that it will retain its place in the piece, it shall be considered a sound knot."

Paragraph 69, Appendix B, Paragraph 43
S. P. A. reads:

"A hollow knot is one containing a hole over 1/4 inch in diameter."

Paragraph 79, Appendix B, Paragraph 45
S. P. A. reads:

"A small pitch pocket, etc."

Paragraph 80, Appendix B, Paragraph 46
S. P. A. reads:

"A medium pitch pocket is one over 1/8 inch but not over 1/4 inch in width and not over 3 inches in length."

Paragraph 81, Appendix B, Paragraph 47
S. P. A. reads:

"A standard pitch pocket is one over 1/4 inch but not over 3/8 inch in width and not over 3 inches in length."

Paragraph 82, Appendix B, Paragraph 48
S. P. A. reads:

"Permissible for a standard pitch pocket."

Paragraph not in Appendix B, Paragraph 49.
S. P. A. reads:

"A through pitch pocket is one which shows an opening on both sides of a piece, and when 1/8 inch or more in width, it shall be considered the same as a knot hole of equal size."

Paragraph 73, Appendix B, Paragraph 50
S. P. A. reads:

"Pitch is an accumulation of a resinous nature, penetrating or saturating the fiber of the wood."

Paragraph 85, Appendix B, Paragraph 51
S. P. A. reads:

"A pitch streak is a well defined accumulation of pitch at one point in the piece, and when not sufficient to develop a well defined streak, or when fibers between grains are not saturated with pitch, it shall not be considered a defect."

Paragraph 87, Appendix B, Paragraph 53
S. P. A. reads:

"By 1/6 the length of the surface on which it occurs."

Paragraph 88, Appendix B, Paragraph 54
S. P. A. reads:

"A standard pitch streak is one whose area does not exceed 1/6 the width by 1/3 the length of the surface on which it occurs."

Paragraph 89, Appendix B, Paragraph 55
S. P. A. omits:

Last sentence of paragraph on Appendix B.

Paragraph 98, Appendix B, Paragraph 59
S. P. A. omits:

"Or 1/6 its length."

Paragraph 101, Appendix B, Paragraph 62
S. P. A. omits:

"It is classified as light, medium, and heavy," but adds, "Stain, such as usually occurs in the drying process, or which occurs as a result of shipping lumber green, when so ordered, shall not be considered a defect in any of the grades of common lumber."

Paragraph 112, Appendix B, Paragraph 133,
reads:

"The following amount of crook, based on 16-foot lengths shall be permissible in all grades of Finish:

1″ and 1¼″ x 3″..............3″
1″ and 1¼″ x 4″..............2½″
1″ and 1¼″ x 5″ and 6″......2″
1″ and 1¼″ x 7″ and 8″......1¾″
1″ and 1¼″ x 9″ and 10″......1¼″
1″ and 1¼″ x 11″ and 12″......1″

For 1 1/2-inch and 2-inch thickness, crook 1/2-inch less than above is permissible.

Pieces longer or shorter than 16 feet may have proportionate amounts of crook."

Paragraph 202 S. P. A. reads:

"The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 and No. 2 Common grades of Common Boards and Strips.

3, 4, 5 and 6-inch widths....3- inch crook
7 and 8-inch widths........2½-inch crook
9 and 10-inch widths........2- inch crook
11 and 12-inch widths........1¾-inch crook

Pieces longer or shorter than 16 feet may have proportionate amounts of crook. A greater amount of crook shall be permissible in No. 3 and 4 Common grades."

Paragraph 219 S. P. A. reads:

"The following amount of crook, based on 16-foot lengths, shall be permissible in No. 1 Common Dimension and Heavy Joists.

4-inch widths.......1½-inch crook
6-inch widths.......1⅜-inch crook
8-inch widths.......1¼-inch crook

Therefore, when we build, let us think that we build . . . forever. Let it not be for present delight, nor for present use alone, let it be such work as our descendants will thank us for, and let us think, as we lay stone on stone, that a time is to come when those stones will be held sacred because our hands have touched them, and that men will say as they look upon the labor and the wrought substance of them, 'See! this our fathers did for us.'

—*John Ruskin*

UNIVERSAL PORTLAND CEMENT CO.
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10-inch widths.....1⅛-inch crook
12-inch widths.....1- inch crook

In No. 2 Common, crook 1/2 inch more than above is permissible. In either grade pieces longer or shorter than 16 feet may have proportionate amount of crook."

Paragraph 113, Appendix B, Paragraph 134, reads:

"Based on a piece 12 inches wide, 1/4 inch cup shall be permissible in all grades of Finish. Narrower or wider pieces may have proportionate amounts of cup."

The following paragraphs found in Appendix B of American Lumber Standards are omitted in Southern Pine specifications as irrevelant to the grading of Southern Pine.

Paragraphs 3, 4, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 21, 23, 24, 41, 42, 43, 48, 49, 50, 61, 62, 63, 64, 66, 70, 71, 72, 74, 75, 76, 77, 83, 90, 92, 93, 94, 95, 102, 103, 104, 106, 107, 108, 110, 114.

Paragraph 26, A. L. S., Paragraph 90 S. P. A. reads:

"1/2 off on lumber of standard widths 8 inches to 12 inches, and 5/8 inch off on lumber of standard widths 13 inches and wider."

Paragraph 30 A. L. S., Paragraph 94 S. P. A., continues:

"And widths 13 inches and wider shall be not more than 1/2 inch less than the nominal widths."

Variations in existing Southern Pine Association Specifications from Standard Lumber Grades.

Grade "B," Paragraph 137 S. P. A., reads:

"'B' finish will admit, in addition to one split in end which shall not exceed in length the width of the piece, two or combination of two of any of the following defects or their equivalents.

Wane 1 inch in width, 1/4 inch in depth and 1/6 the length of the piece.

Two small knots; one standard knot; one standard pitch pocket; two medium pitch pockets; three small pitch pockets; two small pitch streaks; one standard pitch streak."

Grade "C," Paragraph 138 S. P. A., reads:

"'C' finish will admit in addition to one split in end which shall not exceed in length the width of the piece, two or combination of two of any of the following defects or their equivalents.

Wane 1 inch in width, 1/2 inch in depth and 1/3 length of piece.

Two standard knots.

Two standard pitch pockets.

Six small pitch pockets.

Two standard pitch streaks.

25 per cent stain.

Pith not exceeding 1/4 inch in width."

No. 1 Common, Paragraph 209 S. P. A. reads:

"knots, the average diameter of any one knot not to exceed approximately 1 1/2 inches in 3 and 4-inch widths, 2 inches in 6 and 8-inch widths, 2 1/2 inches in 10-inch widths, 3 inches in 12-inch widths, and not over 3 1/2 inches in wider widths.

Two pith knots.

Shake that does not go through the piece.

Wane 1 inch in width, 1/2 inch in depth, and 1/3 length of the piece."

No. 2 Common, Paragraph 212 S. P. A., reads:

"knots not necessarily sound, the average diameter of any one knot not to exceed approximately 1 1/2 inches in 3-inch widths, 2 1/2 inches in 4-inch widths, 3 inches in 6-inch widths, 3 1/2 inches in 8-inch widths, 4 inches in 10-inch widths, 4 1/2 inches in 12-inch widths, and 5 inches in wider widths.

A knot hole or the equivalent, not to exceed 2 inches in diameter.

Through shake not to exceed 1/2 the length of the piece.

Wane 2 inches wide, one-half the length of the piece.

Pitch pockets.

Worm holes.

Advanced decay 1/4 the length of the piece or its equivalent in unsound red heart.

Miscut or mismanufactured 1-inch Common, which does not fall below 3/4 inch in thickness, shall be admitted in No. 2 Common, provided the grade of such stock is otherwise as good as No. 1 Common."

No. 3 Common, Paragraph 213 S. P. A., reads:

"or other defects which will not prevent its use as a whole for cheap sheathing or which will cut 75 per cent of lumber as good as No. 2 Common."

SIMPLIFIED PRACTICE REOMMENDATION.

7. SHINGLES.

Grades.

55. (61.) The basic grades of shingles shall be A, B, C, and D.

Sizes.

56. (63.) 16-inch 6/2 shingles and 18-inch 5/2 shingles be eliminated.

57. (66.) Dimension shingles shall be sold full net count, no dimension shingle to be less than 1/8 inch scant of the specified width when dried.

Shipping Provisions.

58. (64.) The kiln-dried weight of shingles be not more than 10 per cent under the present association shipping weights.

59. (65.) The openings shall not exceed an average of 1 inch to the course in random-width shingles.

Specifications for Red Cedar Shingles.

60. (62.) The specifications of 24, 18, and 16-inch red cedar shingles shall be as shown in attached Appendix D.

IV. SIMPLIFIED PRACTICE RECOMMENDATION.

BASIC PROVISIONS FOR STRUCTURAL MATERIAL.

Basic Provisions for the Selection and Inspection of Softwood Dimension and Timbers where Working Stresses are Required.

The following basic provisions are to be used as bases for the preparation of grading rules for structural material by the Manufacturers, to be submitted by the Central Committee on Lumber Standards for consideration as American Lumber Standards at the next General Conference in 1926.

1. GRADES AND CLASSIFICATION.

61. **Grades:** **(a) Dense Select.**
(b) Select.
(c) Common.

62. **Uses:** **(a) Joist and Plank.**
Joists, Rafters, Scaffold Plank, Factory Flooring, etc.
(b) Beams and Stringers.
Beams, Girders, Stringers, etc.
(c) Posts and Timbers.
Posts, Caps, Sills, Timbers, etc.

2. GENERAL PROVISIONS.

63. All grades shall contain only sound wood, unless decay is specifically permitted.

64. The measurement of a knot shall be made on the section of the knot appearing on the surface under consideration.

65. In Post and Timber grades, and on the wide faces of Joist and Plank, the measure of a knot shall be on the mean or average diameter.

66. On the narrow faces of Joist and Plank and Beams and Stringers, the size of a knot shall be taken as its width between lines parallel to the edges of the timber.

67. On the wide or vertical faces of Beams and Stringers, the smallest diameter of a knot shall be taken as its size.

68. Knots on the edges of wide faces of Beams and Stringers are limited to the same size as on the adjacent narrow faces.

69. Knots on narrow faces and edges of wide faces of Joist and Plank and Beams and Stringers, may increase proportionately from

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the size allowed in the middle third to twice that size at the ends of the piece.

70. The size of knots on the wide faces of Joist and Plank and Beams and Stringers, may increase proportionately from the size allowed at the edge to that allowed at the center line.

71. Cluster knots and knots in groups are not permitted.

72. Knot holes and holes from other causes than knots shall be limited as provided for knots.

73. Shake shall be measured on the ends of a piece, and its size shall be taken as its width between lines parallel to the wide faces of the piece. Checks and splits shall be limited as provided for shakes. No checks or combinations of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

74. No combination of wane and knots is permitted which would reduce the strength more than the maximum allowable knot.

75. No pieces of exceptionally light weight shall be permitted in any grade, except that very light pieces otherwise of Select grade may be accepted in the Common grade.

76. No heartwood requirements are provided in these grades. Heartwood requirements when ordered should be specified in terms of heartwood required on the girth or on each face, side or edge. Girth shall be measured at the point where the greatest amount of sapwood occurs.

77. Methods of measurement of Douglas fir and southern pine for rate of growth and density are given for use with the Dense Select and Select Grades.

78. Wane is permitted in all grades, but square edges may be specified when appearance or use requires.

3. SELECTION FOR RATE OF GROWTH.

Douglas Fir or Southern Pine.

79. **Douglas Fir** or **Southern Pine** selected for close grain shall average on either one end or the other not less than six nor more than twenty annual rings per inch, measured over a three-inch portion of a radial line representative of the average growth on the cross section located as described below.

When such radial line is not representative, it shall be shifted sufficiently to present a fair average, but the distance from the pith of the three-inch portion of the line shall not be changed.

In case of disagreement two radial lines shall be chosen, and the number of rings shall be the average of these lines.

Location of Radial Line.

80. **Douglas Fir.** In side cut pieces the line shall be at a right angle to the annual rings and the center of the three-inch portion of the line shall be at the center of the end of the piece.

In boxed heart pieces the line shall run from the pith to the corner farthest from the pith. When the least dimension is six inches or less the three-inch portion of the line shall begin at a distance of one inch from the pith. When the least dimension is more than six inches the three-inch portion of the line shall begin at a distance from the pith equal to two inches less than one-half the least dimension of the piece.

If a three-inch portion of the radial line cannot be obtained the measurement shall be made over as much of the three-inch portion as is available.

81. **Southern Pine.** In boxed heart pieces the rate of growth shall be counted over the third, fourth, and fifth inches from the pith along the radial line.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over three inches on an approximate radial line beginning at the edge nearest the pith in timbers over three inches in thickness and on the second inch nearest to the pith in timbers three inches or less in thickness.

In material containing the pith but not a five-inch radial line, which is less than two inches by eight inches in section or less than eight inches in width, that does not show over sixteen square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a five-inch radial line, the inspection shall apply to the three inches farthest from the pith.

4. SELECTION FOR DENSITY.

82. **Douglas Fir** or **Southern Pine** selected for density shall average on either one end or the other not less than six annual rings per inch and in addition one-third, or more, summerwood, over the same portion of a radial line as provided for selection for rate of growth. Cross-grained material excluded by this rule shall be accepted as dense if averaging one-half, or more, summerwood.

The contrast in color between summerwood and springwood shall be sharp and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

In case of disagreement two radial lines shall be chosen and the summerwood and number of rings shall be the average of these lines.

5. JOIST AND PLANK.

Joists, Rafters, Scaffold Plank, Factory Flooring, etc.

83. **Nominal thicknesses:** 2″ to 4″.
Nominal widths: 4″ and wider.
Standard thicknesses, S1S or S2S: 3/8″ off.
Extra Standard thickness, 2″, S1S or S2S: 1/4″ off.
Standard width, 2″ to 7″, S1E or S2E: 3/8″ off.
8″ and wider, S1E or S2E: 1/2″ off.
Standard lengths: Multiples of two feet.

84. **Knots on Wide Faces**

Width of face	Dense Select and Select: On or near edge middle third of length	Dense Select and Select: Center line of face	Common: On or near edge middle third of length	Common: Center line of face
4″	3/4″	1 1/4″	1″	1 3/4″
6″	1″	2″	1 1/2″	2 1/2″
8″	1 3/8″	2 5/8″	2″	3 3/8″
10″	1 3/4″	3 1/4″	2 1/2″	4 1/4″
12″	2 1/8″	4″	3″	5 1/8″
14″	2 3/8″	4 1/4″	3 1/4″	5 5/8″
16″	2 1/2″	4 5/8″	3 3/8″	6″

85. **Knots on Narrow Faces of Boxed Heart Pieces, Middle Third of Length**

Thickness of piece	Size of Knot: Select	Size of Knot: Common
2″	5/8″	7/8″
3″	1″	1 1/4″
4″	1 1/4″	1 3/4″

86. **Sum of Diameters of Knots, Center Half of Lengths on Any Face, Not to Exceed**

Dense Select & Select	Common
1 1/2 times width of face	Two times width of face

87. **Shakes and Checks**

	Dense Select & Select	Common
Green	1/4 width of end	1/10 width of end
Seasoned	1/8 width of end	1/9 width of end

88. **Angle of Grain, Center Half of Length**

Dense Select & Select	Common
1 in 12	1 in 10

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89. **Wane**

Dense Select & Select	Common
⅛ thickness and/or width	¼ thickness and/or width

90. Douglas fir or southern pine Select grade to be selected for rate of growth.

Douglas fir or southern pine of Dense Select grade to be selected for density.

6. BEAMS AND STRINGERS.

Beams, Girders, Stringers, etc.

91. **Nominal thicknesses:** 5″ and thicker.
Nominal widths: 8″ and wider.
Standard lengths: Multiples of two feet.
S1S, S1E, S2S or S4S: 1/2″ off each way.

92. **Knots.**

Width of face	Dense Select and Select: Narrow face and edge of wide face middle third of length	Dense Select and Select: Center line of wide face	Common: Narrow face and edge of wide face middle third of length	Common: Center line of wide face
5″	1¼″	......	2″	......
6″	1½″	1½″	2⅜″	2⅜″
8″	1¾″	2″	2¾″	3⅛″
10″	2″	2½″	3⅛″	4″
12″	2⅛″	3″	3⅜″	4¾″
14″	2¼″	3¼″	3⅝″	5⅛″
16″	2⅜″	3⅜″	3⅞″	5½″
18″		3⅝″		5⅞″
20″		3⅞″		6⅛″
22″		4″		6½″
24″		4¼″		6¾″

93. **Sum of Diameters of Knots, Center Half of Lengths on Any Face, Not to Exceed**

Dense Select & Select	Common
Width of face	1½ times width of face

94. **Shakes and Checks**

	Dense Select & Select	Common
Green ...	¼ width of end	4/10 width of end
Seasoned	⅓ width of end	4/9 width of end

95. **Angle of Grain, Center Half of Length**

Dense Select & Select	Common
1 in 15	1 in 10

96. **Wane**

Dense Select & Select	Common
⅛ thickness and/or width	¼ thickness and/or width

97. Douglas fir or southern pine Select grade to be selected for rate of growth.

Douglas fir or southern pine of Dense Select grade to be selected for density.

7. POSTS AND TIMBERS.

Posts, Caps, Sills, Timbers, etc.

98. **Nominal sizes:** 6″ x 6″ and larger.
Standard lengths: Multiples of two feet.

S1S, S1E, S2S or S4S: ½″ off each way.

99. **Knots.**

Width of face	Size of knots: Dense Select and Select	Size of knots: Common
6″	1½″	2⅜″
8″	2″	3⅛″
10″	2½″	4″
12″	3″	4¾″
14″	3¼″	5⅛″
16″	3⅜″	5½″
18″	3⅝″	5⅞″
20″	3⅞″	6⅛″
22″	4″	6½″
24″	4¼″	6¾″

100. Sum of diameters of all knots within any 6″ of length not to exceed twice size of maximum knot allowable; nor to be two of maximum allowable knots in same 6″ of length on any one face.

101. **Shakes and Checks.**

	Dense Select & Select	Common
Green....	4/10 width of end	1/2 width of end
Seasoned .	1/2 width of end	6/10 width of end

102. **Angle of Grain.**

Dense Select & Select	Common
1 in 10	1 in 8

103. **Wane.**

Dense Select and Select

⅛ thickness and/ or width

Common

¼ thickness and/ or width

104. Douglas fir or southern pine of Select grade to be selected for rate of growth.

Douglas fir or southern pine of Dense Select grade to be selected for density.

Dimension and Heavy Joists on Joist and Plank where Working Stresses are Required.

Variations in existing Southern Pine Association specifications from the requirements contained in A. L. S.

Paragraphs 84-85 A. L. S., Paragraph 221 S. P. A. reads:

"No. 1 Common Dimension and Heavy Joists must be suitable for use without waste as substantial structural material, and will admit the following defects or their equivalent:

Any number of sound, encased, and pith knots, the average diameter of any one knot not to exceed 2 inches in 2x4's, and in wider stock, not to exceed approximately one-third of the cross-section of the piece, in the rough, at any point throughout its length if located at the edge, nor more than one-half the cross-section if located away from the edge; unsound, loose, or hollow knots, 1/2 the diameter of maximum size sound knots permitted."

Paragraph 87 A. L. S., Paragraph 221 S. P. A. reads:

"surface or through checks."

Paragraph 89 A. L. S., Paragraph 221 S. P. A. reads:

"wane, one-half the thickness, one-quarter the width, and one-third the length of the piece."

Note: Southern Pine Association specifications for Dimension and Heavy Joists do not cover the provisions in American Lumber Standards covered by paragraphs 85, 86, 88, 90 of A. L. S.

Variations in existing Southern Pine Association specifications from Basic Provisions for the selection and inspection of softwood dimension and timbers when working stresses are required.

Select Structural Material.

Paragraph 92 A. L. S., Paragraph 37 S. P. A. reads:

"shall not have in Volume 1 sound knots greater in diameter than one-fourth the width of the face on which they appear—maximum knot 1½ inches. Shall not have in Volume 2 sound knots greater in diameter than one-half the width of the face on which they appear—maximum knot 3 inches."

Paragraphs 93-100 A. L. S., Paragraph 38 S. P. A. reads:

"The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face."

Paragraph 99 A. L. S., Paragraph 40 S. P. A. reads:

"Shall not have sound knots greater in diameter than one-third the least width of the column—maximum knots 4 inches."

Paragraphs 94-101 A. L. S., Paragraph 41 S. P. A. reads:

"Round or ring shakes shall not occupy, at either end of a timber, more than one-fourth width of green material. nor more than one-third the width of seasoned material."

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Paragraph 42 S. P. A. reads:

"Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable round shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber."

Paragraphs 95-102 A. L. S., Paragraph 43 S. P. A. reads:

"Shall not have diagonal grain with slope greater than one in twenty in Volume 1. No. 1 Common Timbers.

Paragraphs 96-103 A. L. S., Paragraph 22 S. P. A. reads:

"May have wane on one corner one-third the length of the piece, or its equivalent on two or more corners, the wane measured on its face."

Paragraph 23 S. P. A. reads:

"Timbers 10 x 10 in size may have 2-inch wane as above; the larger sizes may have wane as above in proportion to sizes."

Paragraphs 92-99 A. L. S., Paragraph 24 S. P. A. reads:

"Common timbers may contain sound knots and pith knots, provided that the diameter of any one knot shall not exceed the following in size:

2"	in	4	x	4 to	6	x 6
2½"	in	6	x	8 to	8	x 10
3"	in	10	x	10 to	10	x 12
3½"	in	12	x	12 to	12	x 14
4"	in	14	x	14 to	14	x 16
4½"	in	16	x	16 to	16	x 18

In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified."

Paragraphs 94-101 A. L. S., Paragraph 26 S. P. A. reads:

"Will admit shakes extending one-sixth the length of the piece, round or ring shakes, and seasoning checks.

In Southern Pine Association specifications for structural material two grades have been interposed between Select and Common, namely, "Merchantable" and "Square Edge and Sound."

Square Edge and Sound Timbers.

S. P. A. specifications, Paragraph 27—May be either Dense or Sound Pine.

Paragraph 28—Unless otherwise specified, this grade will admit any amount of sapwood.

Paragraph 29—Square Edge and Sound Timbers shall be well manufactured and shall be free from defects such as ring or round shakes and through shakes that extend to the surface, unsound and loose knots and knots in groups that will materially impair the strength, and shall be free from wane. Seasoning checks and sap stain shall not be considered defects.

Merchantable Timber.

S. P. A. Specifications, Paragraph 30—May be either Dense or Sound Pine.

Paragraph 31—Merchantable Timbers shall be well manufactured and shall be free from defects such as injurious ring and round shakes and through shakes that extend to the surface, unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and sap stain shall not be considered defects.

Sizes under 9 inches on the largest dimension shall show two-thirds or more heart surface on one of the wide faces; sizes 9 inches and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square the face showing the most heart shall govern the inspection on sizes under 9 inches and the two faces showing the most heart shall govern the inspection when 9 inches and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirements of this quality.

Paragraph 33—Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on one corner, or the equivalent on two or more corners, or not to exceed ten per cent of the piece, shall be admitted.

ABBREVIATIONS OF TIMBER GRADES.

For the purpose of branding timbers with the names of the grades it is recommended that the following abbreviations be used:

SEL STRUC—Select Structural.
MERCH—Merchantable.
SQ EDG-SD—Square Edge and Sound.
No. 1 COM.—No. 1 Common.

ARCHITECTS' SPECIFICATIONS FOR SOUTHERN PINE STRUCTURAL TIMBERS.

(1) When Both Maximum Durability and Strength are Required.

Southern Pine of "dense select" structural material grade in accordance with the definition of "Dense Select" Southern Pine in American Lumber Standards as adopted May 1, 1925, and in the "Timber Rule" book of the Southern Pine Association, Jaunary 1, 1917, to be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(2) When Strength is Required Without Special Reference to Durability.

Southern Pine of "Dense Select" structural material grade as defined in Section (1) next preceding. To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(3) When Used Without Reference to Durability or Maximum Strength.

No. 1 Common Southern Pine timbers of "Common" grade selected for rate of growth in accordance with the definition of "Common" southern pine in American Lumber Standards as adopted May 1, 1925, and in the "Timber Rule" book of the Southern Pine Association January 1, 1917. To be dressed to standard sizes conforming to the rules of the Southern Pine Association.

(4) When Used for Joists, Studs, etc., in Ordinary or Minor Structures, Without Reference to Durability or Maximum Strength.

No. 1 Common Southern Pine of "Common" grade in accordance with the definition of "Common" southern pine in American Lumber Standards as adopted May 1, 1925, and in the "Timber Rule" book of the Southern Pine Association January 1, 1917. To be dressed to standard sizes conforming to the rules of the Southern Pine Association.

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(5) When Durability and Maximum Strength are Required.

Southern pine of "Merchantable" grade selected for rate of growth as defined in American Lumber Standards as adopted May 1, 1925, and in the "Timber Rule" book of the Southern Pine Association, January 1, 1917. To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(6) When Strength is Required Without Reference to Durability.

Southern pine of "No. 1 Common" grade as defined in American Lumber Standards as adopted May 1, 1925, and in the Standard Specifications for grades of Southern Pine Lumber of the Southern Pine Association, November 1, 1925. To be dressed to standard size conforming to the rules of the Southern Pine Association.

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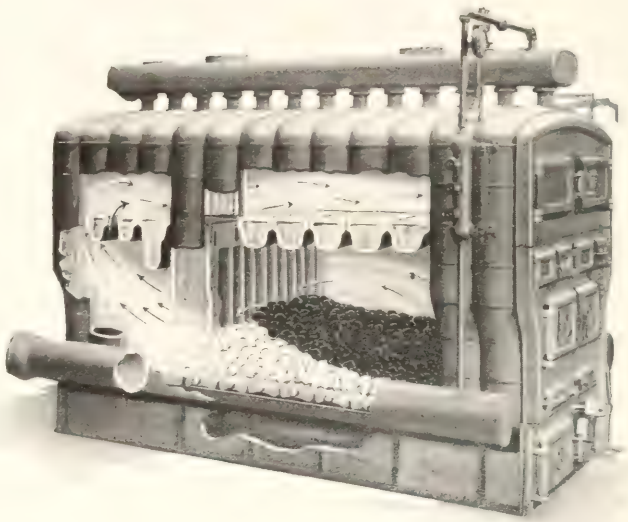

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HEATING AND VENTILATION

Edited by Fred J. Postel, Mech. Engr.

HEATING.

In considering the installation of a heating system, the architect or engineer in almost every instance has his choice of three types, namely, steam, hot water and hot air. Both steam and hot water systems are fundamentally the same in principle regardless of the size of the installation, although, of course, there are modifications and variations in the application, to meet local conditions.

In hot air heating installations the smaller installations are almost always gravity systems, while the larger installations are almost always mechanically operated systems, i. e., the air is moved by means of fans.

As a matter of convenience, we may divide heating systems into two general classes, those using piping and radiating surfaces (steam and hot water systems) and those using ducts (hot air furnaces and hot blast systems).

STEAM VS. HOT WATER:

Before taking up the systems of the first class in detail, it may be well to consider some of the outstanding advantages and disadvantages of each. To simplify the discussion, the simple gravity system of each type is referred to in this comparison. Numerous improvements and modifications have been developed for both steam and hot water systems in order to gain some of the advantages of the other system. These naturally involve the installation of devices more or less automatic, but all requiring a certain amount of attention to keep them in operation. The question of whether the advantage gained warrants the expenditure both in first cost and in operation and maintenance, will depend on local conditions and no general rule will apply.

Generally speaking, the advantage of steam over hot water, is lower first cost, smaller radiators and smaller piping. The principal disadvantage is the fact that the temperature of the radiating surface cannot be regulated to meet the demands of the weather conditions. Again, the system is operative only so long as there is pressure in the mains. If the pressure is allowed to fall to atmosphere, circulation ceases, and the building is, to all intents and purposes, without a heating system, even though there is a smoldering fire in the furnace.

The advantage of the hot water heating system is that the temperature of the water may be varied with the demands of the service. With a properly designed system the water circulates at a very low temperature, so that a smoldering fire will produce sufficient circulation in mild weather. This feature makes it possible also to continue heating the building after the fire has been banked for the night.

The principal disadvantages of a hot water system are the greater first cost, larger radiators and piping, and the ever present possibility of damage to decorations and furnishings, as a result of a leak in the system.

The "vapor" system of steam heating and the so-called "modulation" system, both provide excellent means of temperature regulation and in this respect approach the advantages of a hot water system.

On the other hand, to overcome the disadvantage of large, ungainly radiators and piping in hot water systems, various devices have been developed to increase the temperature of the water under conditions of extreme demand. These systems depend on increasing the pressure on the water above atmosphere and are what may be referred to as closed systems, either wholly or in part.

STEAM HEATING.

In designing a system of steam heating, it should first be determined whether the conditions will be best met by a gravity, or a vacuum system.

In a gravity system, the mains and radiating surface are so laid out that all condensation returns to the boiler by gravity and no machinery is required to keep the system in operation. This system is necessarily operated at a pressure above atmosphere so that the pressure in the radiators is sufficient to expel the air from the system.

Practically all the vacuum systems being installed today remove the condensate and the entrained air through the same pipe. Another type of vacuum system in which each heating unit was provided with an air valve and these valves connected to a vacuum pump was in quite general use some years ago but is seldom used now.

The term "vacuum system" as used in this discussion will be taken to mean a system in which each individual heating unit is provided with a thermostatic or float type of trap and the condensate and air removed through a system of piping by means of a vacuum pump. In this connection it may be stated that in the case of large installations in which a group of buildings is sup-

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Brick-Set Up Draft Fire-Box

This has been the Standard Boiler for general use in the Cental West for many years, and is the Boiler referred to in specifications as "Kewanee or equal".

Number of Boiler		1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20
Capacity, Steam	sq. ft	900	1050	1200	1400	1700	2000	2600	3000	3500	4000	4500	5500	6500	7500	8700	10000	11000	12000	14000
Capacity, Water	sq. ft	1500	1700	2000	2300	2800	3300	4300	5000	5800	6600	7400	9100	10700	12400	14400	16500	18200	19800	23100
Diameter Boiler	in.	30	30	30	36	36	36	42	42	48	48	48	54	54	60	60	66	66	72	72
Diameter of Stack	in	12	12	14	14	16	16	18	20	20	22	22	26	26	30	30	30	30	34	34
Minimum Height of Stack	ft.	40	40	40	40	40	45	45	45	45	50	50	50	50	55	55	60	60	60	60

Brick-Set Smokeless Fire-Box

A Boiler designed to burn soft coal without objectionable smoke, and to comply with municipal smoke prevention requirements.

Number of Boiler	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Capacity, Steam... sq. ft.	1600	2000	2300	2600	3100	3600	4000	4700	5500	6500	7500	8500	10000	11500	13000	14000	16000
Capacity, Water ..sq. ft.	2600	3300	3800	4300	5100	5900	6600	7800	9100	10700	12400	14000	16500	19000	21500	23100	26400
Diameter Boiler ....in.	36	36	36	42	42	42	48	48	48	54	54	60	60	66	66	72	72
Diameter Stack ....in.	18	18	20	20	20	22	22	24	24	28	28	32	32	34	34	36	36
Minimum Ht. Stack..ft.	45	45	45	50	50	50	50	55	55	60	60	60	60	70	70	70	70

Portable Up Draft Fire-Box

Requires less floor space and more height than above. No special skill in brick laying.

Number of Boiler	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424
Capacity, Steam.....sq. ft.	2500	2900	3500	4000	4500	5000	5500	6000	7000	8000	9500	11000	13000	15000	17500	20000	25000	28000
Capacity, Water.....sq. ft.	4100	4800	5800	6600	7400	8300	9100	9900	11600	13200	15700	18200	21500	24800	28500	32000	40000	45000
Diameter Boiler.....in.	48	48	48	54	54	54	60	60	60	60	66	66	72	72	72	78	84	84
Diameter Stack.....in	20	20	20	22	22	22	24	24	26	26	28	30	32	32	34	34	38	40
Minimum Height Stack....ft	50	50	55	55	55	60	60	60	65	65	65	70	70	70	80	90	90	100

Portable Smokeless Fire-Box

A Smokeless Boiler designed to burn cheap soft coal. Breeching connection at front, economical of space.

Number of Boiler	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324
Capacity, Steam..sq. ft.	3000	3500	4000	4500	5000	5500	6000	6500	7500	8500	10000	12000	14000	16000	18000	20000	25000	30000
Capacity, Water..sq. ft.	5000	5800	6600	7400	8300	9100	9900	10700	12400	14000	16500	19800	23100	26400	29700	33000	40000	48000
Diameter of Boiler..in.	48	48	48	54	54	54	60	60	60	60	66	66	72	72	78	78	84	84
Diameter Stack.....in.	20	20	20	22	22	22	24	24	26	26	28	30	32	32	34	34	38	40
Minim'm Ht. Stack..ft.	50	55	55	55	55	60	60	60	65	65	65	70	70	70	80	90	90	100

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plied from a centrla heating plant, the plan is frequently adopted of laying out the system in each buiding as a gravity job; providing one large trap for the entire building and discharging this trap into return mains connected to a vacuum pump. In such a system each building rather than each radiator is treated as a unit. Such a system is not, however, what is ordinarily meant by the term "vacuum" system.

In determining whether the expense of a vacuum system is justified by the conditions, the advantages to be obtained by using it must be carefully considered. The two things which make a vacuum system better than a gravity system are, first, circulation at a lower pressure; second, quick circulation when new radiation is turned on. The former is of particular importance in cases where the exhaust steam from engines is used to heat the building. The efficiency of the engine is increased as the back pressure is decreased. Therefore, the use of a vacuum system may be the means of saving considerable coal. On the other hand, the installation of a vacuum system cannot be justified from the standpoint of economy in coal consumption, if the demand for exhaust steam is so heavy that live steam must be used to make up the deficiency, even with the engine running against a back pressure.

Vacuum systems are sometimes installed where there are no engines and where the system might as well operate at 5 lbs. as at ½ lb. back pressure. The net cost of operating such a system is necessarily greater than would be the case in a gravity system and the only advantage is a somewhat freer circulation, and the fact that the radiators will heat up promptly when the inlet valves are opened.

While the cost of thermostatic or float vacuum valves adds materially to the cost of a vacuum system installation, this increased cost is offset, to a certain extent, by the fact that smaller pipes may be used in a vacuum system than in a gravity system.

A well laid out gravity system of ordinary size should circulate freely with one pound pressure under all ordinary conditions and with not to exceed two pounds pressure in extreme cold weather, when the demand for steam and therefore the velocity of the steam in the pipes reaches a maximum. A vacuum system should not require to exceed one-half to one pound pressure under any conditions.

A gravity system may be either a "one-pipe" or a "two-pipe" system and either of these may be an "up-feed" or a "down-feed" system. Except in the case of very high buildings equally good results can be obtained with either up-feed or down-feed, but where the building is very high there is an advantage in having a down-feed system.

A vacuum system may be either up-feed or down-feed, but will always be a two-pipe or a three-pipe system. The wet vacuum system is always necessarily a two-pipe system. The dry vacuum system when used in connection with cast iron radiation is usually a two-pipe system, the vacuum pipe being a very small pipe with probably ¼-inch branches and a main seldom larger than one inch. Where the dry vacuum system is applied to a coil system of heating in which the steam and returns are separate, the vacuum pipe will be required in addition to the other two, thus making a three-pipe system. As previously stated, the dry vacuum system is now very seldom used.

Inasmuch as the loss of heat from buildings is by radiation and conduction from walls, windows, roof and floor, and by the air which must be replaced by fresh outdoor air for ventilation, heating formulae must necessarily involve the quantities: area of exposed wall, roof and floor, area of glass (including doors) and the cubical contents. Wind exposure and the directions of the pass must also be considered.

Loss of heat through walls, roof, and floor depend upon the construction, the thickness and the materials used as well as the difference in temperature between outside and inside surfaces.

There are a great number of heating formulae in use and it is seldom that the results figured by these various formulae will agree. The formulae are all empirical formulae and are based on average conditions. If the conditions of any particuar case vary considerably from the average, it is quite likely that none of the formulae will give correct results. To illustrate why there is often a wide variation in the amount of radiation calculated as being necessary for a certain installation, let us take the one factor of air changes. Generally speaking, we assume one air change per hour for a room. However, there may be some good reason for assuming that the windows will be open slightly or that for other reasons the room will have two air changes per hour. Obviously the required radiation for the two assumptions will be radically different.

The application of any of the formulae, after all, depends on the architect's or engineer's knowledge of the exact conditions likely to prevail and the factors which should be used for those conditions. In the last analysis, therefore, it is principally a matter of judgment on the part of the designer as to what constants are applicable.

The Chicago Master Steam Fitters' Association have compiled rules for computing radiating surface, published elsewhere in this volume, which will meet the average conditions quite satisfactorily.

PIPE SIZES:

One of the most common scources of error in designing a heating system is in the selection of proper pipe sizes. The cause is probably the fact that some designers fix the sizes according to tables without regard to local conditions. The size of a steam main is determined by the quantity of steam passing through it, the pressure of the steam, and the permissible friction loss. The length of the main is, of course, a factor in the latter item. Thus, it is permissible and good practice to use higher velocities in short mains than in long mains and likewise where the initial steam pressure is four or five pounds and a friction loss of two or three pounds not objectionable, much higher velocity may be used than in designing a system which is expected to circulate with steam at one pound pressure. The proper method of designing steam mains is to determine the initial pressure and the permissible friction loss and then figure the main to produce this loss at the assumed pressure.

In the design of return mains we have substantially the same conditions as in the design of the steam mains and in addition the item of allowable pitch. Where it is

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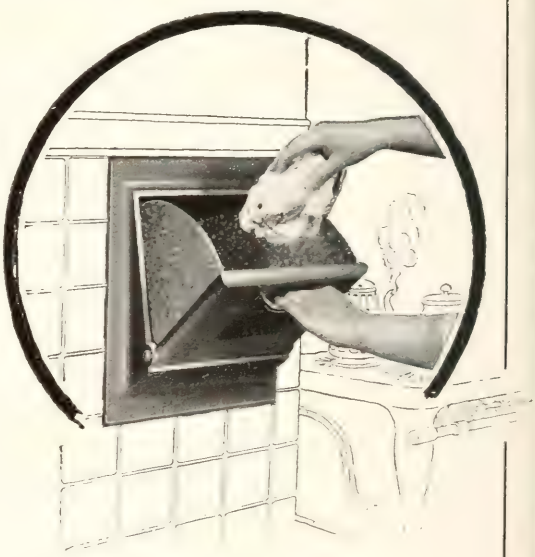

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possible to give return mains considerable pitch they may, of course, be smaller than where they are run more nearly level.

The following table of pipe sizes is based on gravity systems, with short mains, operating at a pressure of from one to three pounds. It is a convenient reference for the conditions on which it is based, but, of course, must not be assumed to fit other conditions.

Radiation up to	One Pipe Work	Two Pipe Work
100 sq. ft........	1¼"	1 "x ¾"
200 sq. ft........	1½"	1¼"x ¾"
400 sq. ft........	2 "	1½"x1 "
600 sq. ft........	2½"	2 "x1 "
900 sq. ft........	3 "	2½"x1¼"
1,400 sq. ft........	3½"	3 "x1¼"
2,000 sq. ft........	4 "	3½"x1½"
3,300 sq. ft........	5 "	4 "x2 "
4,500 sq. ft........	6 "	5 "x2 "
7,000 sq. ft........	7 "	6 "x2½"
9,000 sq. ft........	8 "	7 "x3 "
11,000 sq. ft........	9 "	7 "x3 "
15,000 sq. ft........	10 "	9 "x4 "
24,000 sq. ft........	12 "	10 "x4 "

For vacuum systems the figures for "Two pipe work" may be reduced one pipe size.

HOT WATER HEATING.

In hot water heating the system may be a one-pipe or two-pipe system, and it may be a gravity circulation system or a forced circulation system.

The gravity circulation system is dependent for circulation upon the fact that cold water is heavier than hot water. Therefore, the pitch of supply line should be upward from the boiler (which is the reverse of the requirement in steam heating) and the return should pitch downward toward the boiler as is the case, also, in steam heating.

In forced circulation systems which must usually be used when long horizontal runs are encountered, as is the case in factory heating, where the boiler or source of heat is in a detached power plant, a pump is used.

In one-pipe systems the radiators are connected in shunt with the supply lines, that is, the water to a radiator is taken from supply line, passes through radiator and is returned to supply line at a point further along in the direction of the travel of the water. Special fittings are sometimes employed in the diversion of the water into the radiators, especially in the case of forced circulation systems.

Two-pipe systems, especially in gravity circulation systems, may be considered to have more positive circulation.

Either one-pipe or two-pipe, gravity or forced circulation systems may be closed or open systems, though closed systems are not frequently found except in larger forced circulation systems. In either system an expansion tank must be used because of the expansion of water as its temperature rises.

The formulae which are used in estimating the amount of radiating surface required for steam heating may be used for computing the amount of radiating surface required for hot water heating, providing a factor dependent upon the difference in temperature of the hot water and of the steam is introduced.

SIZE OF HOT WATER MAINS.

(For gravity circulation and low buildings.)

Size of Main	Area	Direct Radiation Will Supply, Feet	Indirect Radiation Will Supply Feet
1½ in.	2.03	200	135
2 in.	3.35	325	200
2½ in.	4.78	450	300
3 in.	7.38	700	450
3½ in.	9.82	900	600
4 in.	12.73	1200	800
4½ in.	15.93	1500	1000
5 in.	19.99	2000	1200
6 in.	28.88	3000	2000
7 in.	38.73	4200	2800
8 in.	50.03	5600	3600
9 in.	63.63	7000	4600
10 in.	78.83	8500	5600

In forced circulation systems it is considered good practice to so proportion mains and returns that velocity of water will not exceed 200 feet per minute.

Carpenter gives as a practical rule, applicable when main and supply do not exceed 200 feet in length, "The diameter of main supply or return pipe in a system of direct hot water heating should be one pipe-size greater than the square root of the number of square feet of radiating surface, divided by 9 for the first story, by 10 for the second story and by 11 for the third story of the building. For indirect hot water, multiply above by 1.5".

BOILERS FOR HEATING SYSTEMS.

Boilers sold for heating installations are rated by manufacturers in square feet of radiating surface, which they will supply, Comparison of boilers sold by different manufacturers discloses the fact that boilers of different makes, having the same amount of heating surface have widely different ratings, as given by the manufacturers; the difference being in some cases nearly 100 per cent.

The capacity of a boiler depends on the form and extent of the heating surface, the water and steam space and upon the amount of grate surface.

Another factor to be considered is the question of whether the boiler is to be installed in a large plant with a fireman constantly on duty and firing at regular intervals, or whether the boiler is to be used in a small installation where it is desirable to have a boiler of sufficient size to permit intermittent firing and even banking for periods of several hours while carrying the connected load.

Power boilers are usually rated at from 7½ sq. ft. to 12 sq. ft. of heating surface per boiler horse power. On account of the difference in the method of firing, a heating boiler should have not less than 15 sq. ft. of

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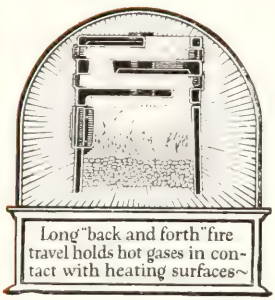
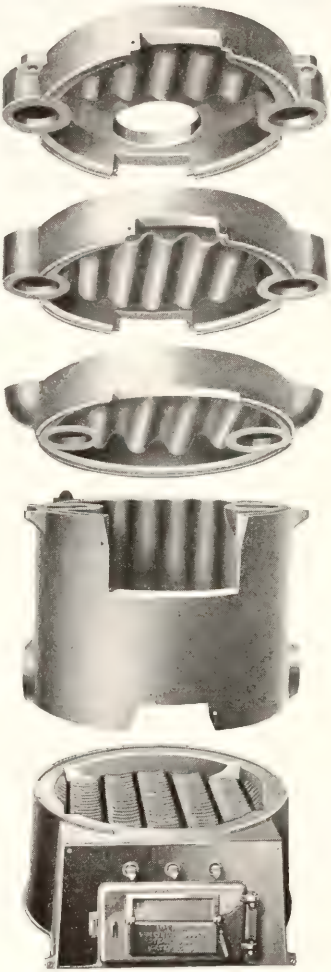
BOILERS

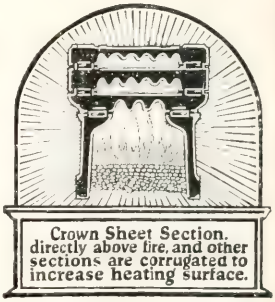
(ROUND TYPE)

(ROUND TYPE)



Long "back and forth" fire travel holds hot gases in contact with heating surfaces.





Crown Sheet Section, directly above fire, and other sections are corrugated to increase heating surface.

The illustration in center above shows a 5 Section Round Type Weil-McLain Boiler with sections separated. Note the corrugated heating surface. Complete catalog gladly sent upon request.

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heating surface per rated horse power. Roughly 100 sq. ft. of radiation requires one boiler horse power.

SIZES OF CHIMNEYS:

The size and height of chimneys will depend on the kind and amount of coal burned; the kind of grate; the type of boiler and also on the location of the chimney relative to surrounding buildings. The latter is of great importance. A chimney which would be of sufficient height out in the country, where it extended above all surrounding buildings, might be totally inadequate in a city where it would be "blanketed" by high adjoining buildings.

In general, however, assuming a short straight breeching; a chimney smooth on the inside, reasonably tight and extending above surrounding buildings; and a good grade of bituminous coal used as fuel, the following sizes will be found ample:

Sq. Feet of Direct Steam Radiation	Horse Power	Size of Chimney	Sq. Feet of Direct Water Radiation
250	2.5	8″x 8″x25′	400
500	5.0	8″x12″x30′	850
800	8.0	12″x12″x35′	1350
1400	14.0	12″x16″x40′	2400
2200	22.0	16″x16″x50′	3700
3500	35.0	18″x18″x60′	5900
5500	55.0	20″x20″x70′	9300
8000	80.0	24″x24″x80′	13000

HOT AIR HEATING

In this classification is generally included the hot air furnace, the hot blast system and indirect steam radiation. The direct-indirect radiation might be included either under this head or under piping and radiator systems.

The hot air furnace is the simplest and usually the most effective of all the various heating systems, but its application is limited to buildings which do not require long horizontal ducts. It is well adapted to small one or two-story residences which do not cover much ground area and in which the furnace can be located in the center of the basement. The hot air furnace has the advantage of low first cost; is efficient in operation, and if properly operated provides better ventilation than either a steam or hot water system. The heating system is in operation almost from the moment a fire is started in the furnace. As soon as the air surrounding the fire pot becomes heated it starts to circulate. A hotter fire increases both the temperature and the volume of the circulating air. This system is, therefore, well adapted for wide ranges of outdoor temperature.

The principal disadvantages of the hot air furnace are the dust and dirt which are carried into the rooms, and the difficulty which is frequently found of maintaining a uniform temperature throughout a building, especially on windy days. Hot air furnaces are seldom air tight and as a result the gas from the combustion chamber as well as dust and dirt enter the air space around the fire pot and are carried up into the rooms through the ducts. The difficulty of maintaining uniform temperatures can be greatly reduced if the system is well designed, particularly with reference to exposure and prevailing winds.

A further objection to the hot air furnace is the fact that the air for heating passes over the surfaces which are heated directly by the flames and which at times may become almost red hot. Dust particles carried in the air are burned as they come in contact with the hot iron surfaces. This produces an offensive fine dust ash, which not only is very noticeable by its odor, but which irritates the nasal membranes.

Hot air furnaces should always be provided with a fresh air supply duct leading outdoors and a recirculating air duct leading to a hallway or other part of the building to which the various rooms connect. Both ducts should have control dampers so that the proportion of fresh outside air and of recirculated air may be regulated, as required by the number of occupants in the building.

Furnaces should also be equipped with water pans in the heated air compartment, to maintain proper humidity. These pans are sometimes placed near the bottom of the air chamber and are consequently surrounded by the cold air, making them very much less effective.

Warm Air Furnace Heating Plant Design follows the same rules in the method of computing its requirements as are heretofore set forth in connection with the discussion on steam and hot water heating.

A simple rule for computing sizes of hot air ducts for furnace systems is as follows: Determine the square feet of radiation that would be required if the room were to be heated by direct steam radiation; multiply this figure by the factors E and F determined from the following tables. The result will be the square inches of area of a round duct required to heat the room. This size may have to be increased or decreased slightly for special conditions:

Let **E** equal factor for exposure, the following table gives approximately correct estimates of proper values for **E**:

North	exposure	E=1.4
East	"	E=1.
N. E.	"	E=1.2
South	"	E=1.
S. E.	"	E=1.
West	"	E=1.4
S. W.	"	E=1.2
N. W.	"	E=1.4

Let **F** equal factor for story location in the case of the gravity system only, then for:

First	story	**F**=1.4
Second	"	**F**=1.2
Third	"	**F**=1.0

Inasmuch as the system is operated by discharging air into a room, it follows that a nearly equal amount of air has to be taken from the room. There will be some leakage, and as the air leaving the room is cooler there will be less cubic feet of air leaving the room than entering. Where it is probable that a room will be closed off most of the time, a return duct should be installed connecting either to the basement or to that part of the building where the recirculating register is located. In short, circulation is essential to satisfactory operation and some provision must be made to secure this circulation.

The House of Kuppenheimer, Chicago, showing unit heaters arranged for taking in air from the outside or recirculating, operated with automatic control. This is a four story clothing shop with 12 ILG Unit Heaters.

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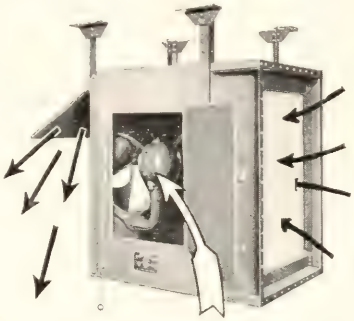

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BLAST SYSTEMS:

Blast systems of heating are essentially the same as simple furnace systems except that the air is moved by a fan. The system is, therefore, much more positive. The air may be heated either directly in a furnace or by being blown or drawn over radiating surfaces heated by steam or hot water. Systems in which the air is heated by radiating surfaces heated by steam are by far the most common.

The size of the ducts is governed by the amount of friction loss permissible and, therefore, by the velocity of the air and the length of duct. Duct velocities vary over a wide range from 300 ft. to 1,500 ft. per minute. Where the power required to operate the fan is of minor importance, as for example, where the fan is driven by an engine which exhausts into the heating coils, high velocities are permissible. These may range from 600 ft. per minute in small ducts to 1,500 ft. per minute in large ducts. On the other hand, where the cost of power to drive the fan is important, it may be more economical to install larger ducts designed for velocities of from 300 ft. in small ducts to 1,000 ft. or 1,200 ft. as a maximum, in large ducts. Register velocities up to 600 ft. per minute are permissible where the register is located near the ceiling. Velocities above 600 ft. are likely to produce objectionable noise. Where the register is located near the floor, velocities as low as 150 ft. to 250 ft. per minute may be necessary in order to avoid objectionable drafts.

The velocity through exhaust registers even though located at the floor, may usually be as high as 400 ft. to 500 ft. per minute, and sometimes, depending on the location, as high as 600 ft. per minute.

The term "indirect heating" is usually applied to the system in which steam or hot water radiation is installed in a compartment or chamber under the floor and outside air permitted to pass over this radiation and into the room to be heated through duct and register. It is, therefore, very similar to the hot air furnace, only that steam or hot water heated radiating surface is used instead of radiating surface heated directly by the flames.

The so-called "direct-indirect" system has the radiators in the room to be heated, connected with the outdoor air, so that the air passing over the radiator is a mixture of fresh outdoor air and air circulating in the room.

Both of these systems have the advantage that they introduce some fresh air and to that extent are desirable from a ventilation standpoint. However, they meet the situation only part way, because the amount of air supplied to the room is usually determined by the outside temperatures rather than by the ventilation needs of the room.

HEATING BY ELECTRICITY.

Heating by electricity is entirely feasible and practical where the cost of electric current is very low. At the ordinary prevailing rates, however, the cost is prohibitive. The reason for this is that where electricity is generated in a steam plant using simple engines, only about 7% of the B. T. U. in the steam is delivered to the switchboard in the form of electrical energy. In stations where the highest type of generating apparatus is used, this percentage may be increased to slightly over 20%.

While the large power boiler is more economical in the production of steam than the small heating boiler, the fact that only 7% to 20% of the steam generated by the large power boiler is available as electrical energy usually makes the cost of this form of heating prohibitive.

TABLE OF EQUIVALENT TEMPERATURE FOR TESTING A HEATING PLANT AT DIFFERENT OUTSIDE TEMPERATURES.

For the purpose of indicating the efficiency of the apparatus for any specified condition, Prof. Carpenter gives the following table, which has been generally accepted as the standard test.

For steam, the radiator temperature in all cases is assumed to be that due to a pressure of 3 pounds at the boiler, or about 220° Fahr.

For water, the radiator temperature is assumed in all cases to be at an average of 160° Fahr.

For a plant proportioned sufficiently to maintain a temperature of 70° when the outside temperature is at zero.

Temperature of Outside Air	Room should be raised to
—10	64.7
0	70.0
10	75.1
20	81.0
30	86.5
40	93.1
50	98.7
60	104.7
70	110.5
80	117.1
90	123.5
100	130.3

See University of Illinois Engineering Experiment Station Bulletin No. 31 for methods and results of tests on house heating apparatus. These tests have been made on different kinds of house heating apparatus with different kinds of fuel. The bulletin embodies the results of about three hundred tests. These bulletins are for free distribution.

VENTILATION.

The term ventilation, when used in the ordinary sense is a purely relative term. Every room or building, unless it is her-

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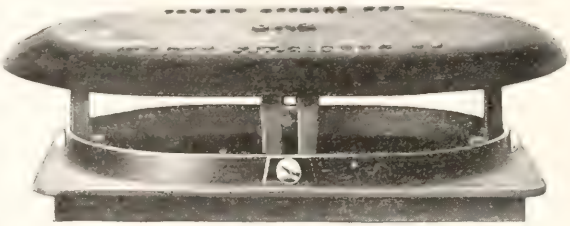

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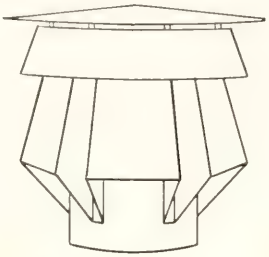

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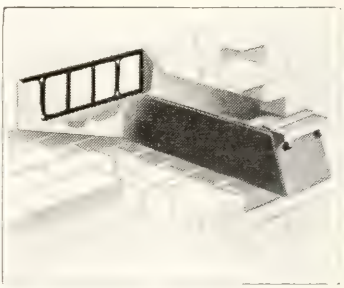

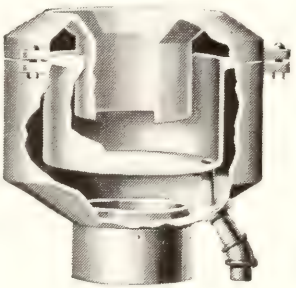

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will last as long as the average building, overcoming the necessity for constant replacement entailed where sheet metal exhaust heads are used. Drain pipes conveniently arranged carry off the condensation.

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metically sealed is "ventilated" to a certain extent. A room heated with steam or hot water direct radiation and with all the windows and doors closed is ventilated by the amount of air leakage, due to the fact that neither the doors nor windows nor even the walls are air tight and there is a constant tendency for the interchange of air from the outside to the inside of the building. With the indirect system of heating, fresh air from the outside is introduced at a definite point and by means of a system entirely under control at all times.

The ducts supplying the air to the indirect radiation are usually provided with dampers, so that the amount of fresh air can be absolutely regulated. From the standpoint of ventilation, indirect radiation is far superior to direct radiation, but on account of the very much greater cost of operation, the amount of indirect radiation is usually restricted to one or two stacks in the ordinary residence.

In laying out any system of ventilation it is necessary to decide first of all on the standard of purity to be maintained. Pure country air contains about four parts of CO2 in 10,000. This amount of CO2 can be increased to 6, 8 and even 10 parts without any bad results to the occupants of the room. Naturally there is no sharp, well defined line above which ventilation is totally bad or below which the ventilation may be referred to as absolutely good. As a general proposition, it may be said, however, that a system of ventilation which permits the CO2 to rise above 12 parts in 10,000 is not a good modern ventilating system, while on the other hand, for commercial reasons, it is seldom that an attempt to keep the air purer than 6 parts of CO2 in 10,000 is made.

It should be clearly understood that the mere presence of CO_2 in such quantities as 12 parts in 10,000 is not in itself harmful. An artificial mixture of fresh country air and sufficient CO_2 to bring the total up to 12 parts of CO_2 in 10,000 would not be in the least injurious. On the other hand, when the air in a room is re-breathed until the CO_2 content reaches 12 parts of CO_2 in 10,000 then that air will contain enough harmful impurities thrown off by the lungs to make it offensive and impure.

The CO_2 content then is an indicator of the purity of the air only when this CO_2 has been thrown off in the breath of persons or animals. In that case, however, it indicates not only the relative purity of the air, but also the air movement or air change at that particular point.

In calculating the probable impurities, it may be assumed that the ordinary person in average good health, exhales 0.6 of a cubic foot of CO2 per hour and a "5-foot" gas burner vitiates about five times as much air as the ordinary person. A ventilated gas grate or any open fire-place, on the other hand, has a tendency to improve the ventilation; for while it uses up oxygen, it must be kept in mind that all the gases which pass up the chimney, must in the natural course of events be replaced by fresh air through the doors and windows.

As incandescent electric lights use up no oxygen, they have no effect on the ventilation of a room. In hospitals the amount of fresh air required for occupants is naturally much greater than in buildings occupied by persons in good health. The amount of fresh air per occupant must be doubled and some times trebled to maintain the required standard of purity.

The Chicago Commission on Ventilation in their report for 1914, says:

"However satisfactory the quantity of air furnished for the ventilation of a room, and however satisfactory may be the means employed for properly distributing it, both of which in the long run are very important, nevertheless the human body makes an immediate demand which may overshadow either or both. IMMEDIATE PHYSICAL COMFORT IS THE STANDARD OF THE HUMAN BODY, whatever the consequences, as exemplified either in the drowsy stupor that descends on one immersed in a hot, stifling atmosphere on a cold wintry night, or in the quiet repose that comes from a balmy summer breeze outdoors. Good ventilation shall produce immediate comfort.

One of the most prominent as well as immediate factors in the production of comfort, is temperature. * * *

The comfort of the human body is largely influenced by the temperature of the surrounding air, and also, and at the same time, by the rate at which perspiration may evaporate into the air from the body. Relative humidity influences the rate at which such evaporation occurs, but it is only in recent years that much consideration has been given to atmospheric humidity in relation to temperature and comfort."

TEMPERATURE AND HUMIDITY IN RELATION TO COMFORT.

"It has become traditional in this country that the best temperature to maintain in a room is 68 to 70 degrees. There are, however, some who urge that these temperatures are too high, and they cite the English practice of 59 to 62 degrees as evidence of their claim. The difficulty with both these positions is that in deciding on the best temperature, proper consideration is not given to relative humidity. Any adult knows that sultry days are much less comfortable than days of even higher temperature when the atmosphere is comparatively dry. This well-known fact of outdoor experience must be taken into account, especially since it is now recognized that in cold weather we need to humidify air indoors. On this point of humidity, it may be said that the human organism seems to be adapted to a large range of relative humidity, but it is not accustomed to abrupt changes such as one might experience on a cold day in passing from the outdoors into a heated room. In a word, it seems important from the standpoint of health and comfort to maintain a fair degree of correspondence between the relative humidity of outdoors and indoors."

"Any system of ventilation to be practicable, must produce a feeling of comfort, and therefore both the temperature and the relative humidity of the air are important in ventilation. Temperature and relative humidity jointly help determine comfort."

"It has generally been considered that a temperature of from 68 to 70 degrees with a relative humidity of 70 percent, is a most desirable condition to obtain (the 70 percent relative humidity also is largely traditional)

"Out of sighte, out of mynde"

Hidden in the walls of the structures that grow from your paper plans, are the valves, fittings and piping that serve the plumbing fixtures in bathroom, kitchen, and laundry, and the heating fixtures all over the building. You can make the old proverb, quoted above, true in every particular by specifying Crane piping materials. They always give dependable, trouble-free, economical long service.

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Crane Idalia Lavatory

In our tests it was assumed that the best temperature may or may not be 68 to 70 degrees; and also the most satisfactory relative humidity may or may not be 70 percent."

Ventilating systems may be divided into gravity and mechanical systems. Air can be moved into and from a room only by some form of power expenditure. When air is warmed, approximately one-third of the heat imparted to it is expended in work of expanding the air and is, in part at least, available for ventilating purposes.

In a gravity ventilating system, the working pressure is due to the difference in weight between the air inside and the air outside of the building or duct. This working pressure is much smaller than the pressures ordinarily used in a fan or mechanical ventilation system.

If the working pressure in a gravity ventilation system is small, the supply and discharge ducts must be made proportionately larger. The cross sectional area of these ducts is governed by the temperature of the air in the supply ducts and the highest outside temperature for which the vent ducts are provided. The cross sectional areas also are modified by the straightness and smoothness of ducts, the height of ducts and numerous other local conditions.

With indirect systems of heating, fresh air from the outside is introduced at definite points where indirect radiation is installed. The ducts supplying the air to the indirect radiation must be provided with dampers so that the amount of fresh air can be regulated. If they were not provided with dampers, the amount of air supplied in cold weather would be excessive and the cost of heating, therefore, would be too great.

The so-called mechanical ventilation systems are superior to gravity ventilation systems in that they require relatively small space for ducts and in the uniformity of ventilation secured, as they are independent of temperature or weather conditions.

The fan system of heating and ventilating is desirable from the ventilating standpoint to just the extent that fresh air is drawn from the outside. It should be understood that it is possible to operate a fan system, drawing the entire supply from the inside of the building. In this case, even though there is a movement of air, the ventilation is no better than with the ordinary direct radiation system.

Systems have been installed in which all the air is recirculated but passed through an air washer before being again delivered to the rooms. The theory is, that washing the air removes its objectionable qualities. There is a decided difference of opinion as to the merits of this system. At this time there is insufficient data at hand to either prove or disprove the claims made.

If all the air is taken from the outside, the combined heating and ventilating system will provide the very best of ventilation. In practice, for purposes of economy, fan systems are usually designed to take most of the air from the outside, but a by-pass is provided so that in extreme cold weather, part of the air can be drawn from the inside of the building.

Quite frequently a combination of a direct heating system and a fan ventilation system is used. In such cases the heating system is usually designed to supply the heat lost by radiation through walls, roof, floor and windows. The fan ventilating system is designed to supply sufficient air to maintain a predetermined standard of purity and is then provided with just sufficient radiation to heat this air to the room temperature.

AIR WASHERS:

The use of air washers in connection with fan vetilating systems, is almost always desirable and in most cases absolutely necessary, in order to assure a supply of clean, pure air.

All air washers consist primarily of a spray chamber in which the air is made to pass through a fine spray of water, and an eliminator or separator in which the water is separated from the air.

The movement of air, containing particles of dust and dirt, through a system of ducts is bound to cause a deposit of part of the impurities on the walls of the ducts. As it is next to impossible to clean the average ventilating duct, this, in time, becomes so dirty that no matter how clean the air leaving the fan, some dirt will be carried into the room through the fresh air registers. From this, it is evident that even though air washers do not remove all of the dust in the air, the use of an air washer improves a ventilating system by just the amount of dirt that the washer removes.

It should also be noted that air washers present a convenient means of increasing the humidity of the air.

BOILER AND PIPE COVERINGS.

Experiments under actual steam plant conditions, conducted by Geo. M. Brill (Trans. Am. Soc. Eng. Vol. XVI) show that in ordinary practice the early results and theories, advanced by Sir Isaac Newton and Peclet, are too low. He found that by using an 8 inch bare steam pipe 60 feet long with an average pressure of 110.5 lbs. by gauge, and with air 75.5 degrees Fahrenheit, that 736.546 B. T. U. per square foot of surface per hour, were lost. These results accord so closely with the experiments conducted by Prof. R. C. Carpenter of Cornell University, and Prof. M. E. Cooley of the University of Michigan, that it seems fair to use these results as a premise of calculation in practical work. The magnitude of the loss from a bare pipe can be understood possibly more closely by the following calculation:

Adopt from Mr. Brill's results a loss of 736 B. T. U. per square foot of surface per hour and, assuming an 8-inch pipe to be 100 feet long, the loss would then be as follows:

736. B. T. U. multiplied by 225 square feet (surface of an 8-inch pipe 100 fee long) equals 165,600 B. T. U. lost per hour.

Dividing by 33,305, which is the number of heat units (B. T. U.) in one boiler horse power, equals 5 boiler horse power per hour lost. The method adopted for preventing it a measure this loss is by the application of some non-conducting material to the radiant body, having for its object the protection of the external surfaces from loss of heat and from any injurious action liable to occur in consequence of their exposure. It will therefore be seen that a great economy can be effected by the application of pipe covering or boiler lagging.

The DUNHAM

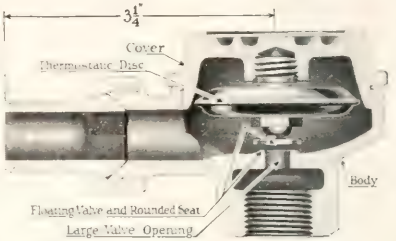
REG. TRADE-MARK

HEATING SERVICE

THE DUNHAM THERMOSTATIC RADIATOR TRAP

Dunham Radiator Traps are made of bronze—the most satisfactory steam metal known for long service under high strain, for changing temperature conditions, and for withstanding the corrosive actions of steam, water and air (which are met with in steam heating systems).

Practical experience (a) in the factors which make steam heating difficult (b) in the relation of the trap to the service the heating system is to render, combined with quality of material used has produced a Trap which offers **an efficiency in operation and a life of service** far in excess of those obtainable through imitative traps made of brittle cast iron or even of brass.



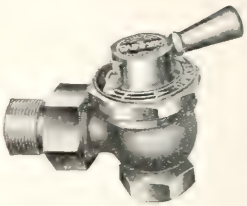
Sectional of No. 1 Trap

The first **Dunham** Trap, put into service in 1903, and the improved trap of today (with the floating valve on thermostatic disc, the rounded valve seat and the standardized roughing-in dimensions) differ in no way in either principle or in method of operation. Just as the Dunham Trap was the first fluid thermostatic radiator trap so is it also the first radiator trap with the floating valve which assures square seating and prevents steam leakage.

THE DUNHAM PACKLESS RADIATOR VALVE

Lever and Wheel Handle Types

The Dunham Packless Inlet Valve is a bona fide packless radiator valve not dependent on springs or packing rings. A most important feature is the **prevention of leakage of air into the radiators of a vacuum system.** The interchangeable parts (for either type of valve) combine a long life, with the final renewals of the working parts at a minimum of cost and inconvenience. The bellows-shaped discs of the Dunham built-up sectional construction are made of the same material which has successfully met the more severe requirements of Dunham Trap service for over twenty years.

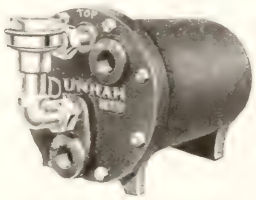


Type 100

On vapor systems as installed in residences and medium size buildings this valve is supplied with a regulating plate, located in outlet of the valve, which controls the flow of steam into each radiator in proportion to its radiating surface. All radiators are thus heated evenly throughout the building. Architects will be quick to recognize the value of having a uniform heat distribution so that the most distantly removed radiator and those on the most exposed parts of the building receive quickly their full quota of heat.

The Dunham Packless Inlet Valve

The Dunham Float and Thermostatic Trap is designed to handle calls for maximum duty. Capacities 3,000 to 16,000 sq. ft. radiation. It is unsurpassed for dripping large low pressure steam mains and risers—domestic hot water heaters—dry kilns—and other low pressure industrial equipment. It opens automatically for water and air, and closes for steam. It is suitable on either gravity or vacuum heating systems.



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CHICAGO MASTER STEAM FITTERS' ASSOCIATION STANDARDS

For Computing Boiler Sizes and Radiation Quantities for Buildings of Average Construction.

RULE FOR COMPUTING RADIATOR QUANTITIES FOR HEATING PLANTS.

The following are rules compiled and recommended by the Chicago Masters Steam Fitters' Association. However, they should not control against the best judgment of the competent designing engineer.

Schedule for computing minimum quantities of steam radiation at 70° F. with outside temperature at minus 10° F.

1 foot of radiation for every 300 cubic feet of contents, plus

1 foot of radiation for every 15 square feet net exposed wall surface, plus

1 foot of radiation for every 2 square feet of single glass surface, plus

1 foot of radiation for every 4 square feet of double skylight.

For all rooms with plastered ceilings and unheated air space between ceiling and the roof, add 1 foot of radiation for every 30 square feet of ceiling area.

For all rooms with ceiling plastered on roof joist add 1 foot of radiation for every 20 square feet of ceiling area.

For all rooms with open joist roof construction add 1 foot of radiation for every 10 square feet of roof.

For all rooms having concrete roof add 1 foot of radiation for every 6 square feet of roof.

For all floors except wood construction having no basement or air space, 1 foot of radiation for every 30 square feet of floor area.

All bath rooms in living abodes to be heated to 80°.

Add 10% to all westerly wall and glass exposure.

Where radiators are placed under seats or behind grills add 20 per cent additional radiation.

Where radiators are placed in open recesses add 10 per cent additional radiation.

For indirect radiation without fan system add 50 per cent additional radiation.

For direct-indirect without fan system add 25 per cent additional radiation.

Where single pipe coils or single cast-iron wall radiation is placed on side walls 80 per cent of the required amount of standard column radiation may be installed. Size of boiler and piping, however, shall be based on standard column radiation requirements. Ceiling coils to be considered as standard column radiation.

In measuring glass surface the full opening in wall shall be figured. Outside door openings shall be taken as glass.

For computing minimum quantities of hot water radiation at 70° F. with outside temperature at minus 10° F., add 60 per cent to amount necessary for steam.

For computing minimum quantities for vapor systems at 70° F. with outside temperature at minus 10° F., add 20 per cent to amount necessary for steam.

A vapor system is defined as a two-pipe steam system which has the return lines open to atmosphere with no valve at the return connections of heating units which will close against steam.

For heating to temperatures other than minus 10° F. to 70° F. multiply actual amount of radiation required by the following coefficients:

—10° to 80°...1.13	—10° to 55°... .81
—10° to 75°...1.06	—10° to 50°... .75
—10° to 70°...1.	—10° to 45°... .69
—10° to 65°... .94	—10° to 40°... .62
—10° to 60°... .87	

RULE FOR COMPUTING BOILER SIZES FOR DIRECT RADIATION

Schedule for computing minimum sizes of boilers for the average building based on approved ratings specified in the manufacturer's catalogue.

Steel tubular or steel water tube boilers 100 sq. ft. per horse power (A. S. M. E. code).

In computing boiler sizes for buildings heated to lower than —10° to 70° F. multiply the amount of cast iron column radiation necessary to maintain the required temperature by the following co-efficient before adding the percentage given in rule for computing boiler sizes.

	Steam.	Water.
—10° to 65°	1.03	1.05
—10° to 60°	1.07	1.09
—10° to 55°	1.10	1.13
—10° to 50°	1.13	1.18
—10° to 45°	1.17	1.24
—10° to 40°	1.20	1.27

RULE FOR COMPUTING BOILER SIZE FOR DIRECT-INDIRECT AND INDIRECT RADIATION

For computing boiler size for **direct-indirect** and **indirect** radiation, reduce same to basis of direct by adding 25 per cent to **direct-indirect** and 50 per cent to **indirect**, then use factor of safety as called for on direct radiation.

RULE FOR COMPUTING BOILER SIZES FOR HOT BLAST COILS

For computing boiler size to be used for Hot Blast Coils use manufacturers' condensation charts, and figure ¼ lb. of condensation per hour as equivalent to 1 square foot of direct radiation and add factor of safety; see x Page 511.

When water for domestic use is heated by heating boiler, size of boiler should be increased, figuring each gallon of water tank capacity as equivalent to 2 square feet of steam radiation or 3.2 square feet of hot water radiation.

For example, a 160 gallon tank should be figured as equivalent to 320 square feet of steam radiation or 512 square feet of hot water radiation, plus factor of safety as indicated on boiler chart showing factors of safety.

The above schedules of quantities are commensurate with good heating results for the average building of average construction, but by no means to be construed as guarantees of the proper quantities of radiation or boiler sizes necessay to heat every building, as extraordinary conditions will of course require additional radiation or boiler capacity.

It is recommended in all installations of steam boilers that drain valves be placed on the returns and that the condensation from such returns be discharged into the sewer for a period of from three days to one week after starting fire, thereby clearing system of grease and dirt. At the end of this period boiler should be thoroughly washed and blown out.

EXAMPLE

Find size of steel down-shaft brick set boilers required for the following installation (Key No. 14 Boiler Chart):

(1) 500 sq. ft. of direct cast iron column radiation in rooms to be heated from —10° to 70°.

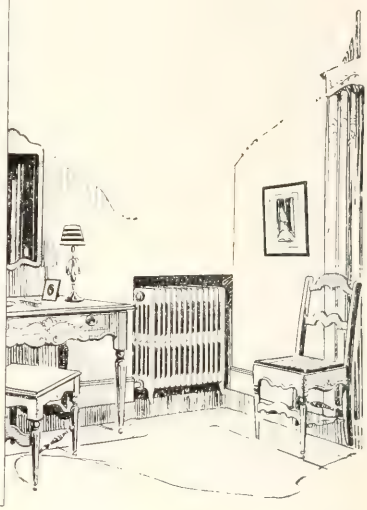
(2) 500 sq. ft. of direct cast iron column radiation in rooms to be heated from —10° to 50°.

(3) 500 sq. ft. of cast iron wall radiation or wall pipe coils (being the equivalent of 625 sq. ft. of cast-iron column radiation) in rooms to be heated from —10° to 50°.

(4) 500 sq. ft. of indirect radiation.

(5) 500 sq. ft. of direct-indirect radiation

CORTO
The Radiator Classic



Beauty that is more than skin deep

THE CORTO RADIATOR adds charm, with its classic lines that harmonize with any decoration. But its beauty is more than skin deep.

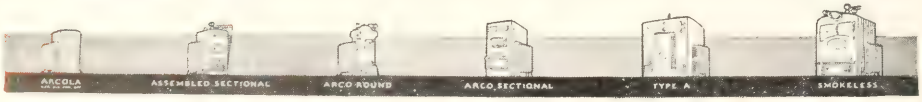
CORTO saves one-third the space occupied by an ordinary radiator. It contains only half the usual amount of water or steam, making circulation more rapid and the boiler more responsive to temperature changes. And its graceful lines make expensive grill-work unnecessary.

Yet, with all these advantages, you add surprisingly little to the cost when you specify CORTO.

AMERICAN RADIATOR COMPANY

816 South Michigan Avenue, Chicago, Ill.

IDEAL BOILERS AND AMERICAN RADIATORS FOR EVERY HEATING NEED



(6) 250 gal. hot water tank. Water to be heated with steam coils.
(7) 500 sq. ft. of cast iron hot blast radiation, regular sections, 5″ centers, 1,000 ft. velocity, air taken from out of doors —10° to F.T. 80. Radiation 3 stacks deep.

ANSWER

(1)	500 sq. ft.	500
(2)	500 sq. ft. + 13%	565
(3)	500 sq. ft. + 25% + 13%	707
(4)	500 sq. ft. + 50%	750
(5)	500 sq. ft. + 25%	625
(6)	250 gal. × 2	500
		3647
	Add factor of safety .261%	952
		4598
(7)	500 × 1.92 × 4 + 10%	4224
	Minimum rated capacity of boilers	8822

SIZES OF LOW PRESSURE STEAM MAINS ONE PIPE CIRCUIT SYSTEM DRIPPED AT END

1″	up to 60	sq. ft.		
1¼″	60	sq. ft. to	100	sq. ft.
1½″	100	sq. ft. to	200	sq. ft.
2″	200	sq. ft. to	400	sq. ft.
2½″	400	sq. ft. to	600	sq. ft.
3″	600	sq. ft. to	900	sq. ft.
3½″	900	sq. ft. to	1,400	sq. ft.
4″	1,400	sq. ft. to	2,000	sq. ft.
4½″	2,000	sq. ft. to	2,600	sq. ft.
5″	2,600	sq. ft. to	3,300	sq. ft.
6″	3,300	sq. ft. to	4,500	sq. ft.
7″	4,500	sq. ft. to	7,000	sq. ft.
8″	7,000	sq. ft. to	9,000	sq. ft.
9″	9,000	sq. ft. to	11,000	sq. ft.
10″	11,000	sq ft. to	15,000	sq. ft.
12″	15,000	sq. ft. to	24,000	sq. ft.

On all piping, proper provision shall be made for expansion and contraction.

All piping shall be properly pitched.

Supply mains shall not be reduced more than one size larger than one-half the diameter of the largest main.

Dry returns shall be not less than one-half the diameter of the supply.

Wet returns may be one size smaller than one-half the diameter of the supply pipe. By supply pipe is meant the size of main at the point of leaving boiler.

All horizontal branches more than 16 feet in length shall be properly dripped.

Supply mains shall not be reduced more than one-half the diameter of the largest main.

Dry returns shall be not less than one-half the diameter of the supply.

Wet returns may be one size smaller than one-half the diameter of the supply pipe. By supply pipe is meant the size of the main at the point of leaving boiler.

PIPE SIZES FOR UP-FEED RISERS

1″	30	square feet or under.	
1¼″	30	to 60	square feet
1½″	60	to 100	square feet
2″	100	to 200	square feet
2½″	200	to 350	square feet
3″	350	to 900	square feet
3½″	900	to 1,200	square feet
4″	1,200	to 2,000	square feet

RADIATOR CONNECTIONS

Up to and including 30 square feet.....1″
Above 30 and including 60 square feet..1¼″
Above 60 and including 100 square feet.1½″
Above 100 square feet.....2″

PIPE SIZES FOR ARMS TO RADIATORS AND BRANCHES TO UPFEED RISERS

1″	up to and	including	20	square feet.
1¼″—	21 and	including	40	square feet.
1½″—	41 and	including	80	square feet.
2″ —	81 and	including	150	square feet.
2½″—	151 and	including	275	square feet.
3″ —	276 and	including	625	square feet.
3½″—	626 and	including	1,050	square feet.
4″ —1,051	and	including	1,600	square feet.

All horizontal branches or arms more than 8 feet in length and not over 12 feet in length shall be increased one size larger than given above.

All horizontal branches or arms more than 12 feet in length and not over 16 feet in length shall be increased two sizes larger than given above.

A New Factor in Building Valuations

It is felt that there is need for a new viewpoint in building valuation. In the past it would seem that too much stress has been placed on age and immediate revenue in building valuation. It would seem that the architect, owing to his peculiar training, is in a position to point out other very important factors entering into value make-up, which have not heretofore been considered in this locality; such as, balance of structural design, adaptability to purposes intended, character of construction as influencing cost of up-keep.

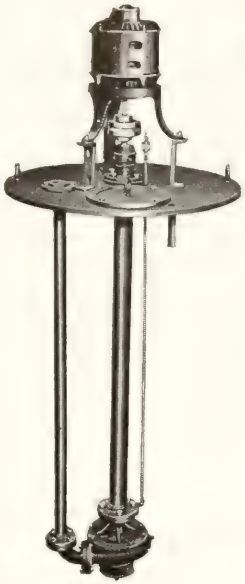
Feeling that the stability of building investment can be better assured by taking the before mentioned factors into consideration, the Illinois Society of Architects has appointed a Building Valuation Committee to furnish the public with competent architectural valuation service. This Committee should form a real asset to the community.

FULL AREA OF TWO-PANE WINDOWS

GIVING THE TOTAL AREA OF TWO-PANE WINDOWS, BRICK OPENING.

Height of Glass / Width of Glass	16″	18″	20″	22″	24″	26″	28″	30″	32″	34″	36″	38″	40″
	TOTAL AREA IN SQUARE FEET												
12″	5.9	6.4	7.	7.5	8.	8.6	9.2	9.8	10.2	10.9	11.4	12.	12.5
14″	6.5	7.1	7.7	8.3	9.	9.6	10.2	10.8	11.4	12.	12.6	13.2	13.8
16″	7.	7.7	.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.	14.4	15.
18″	7.6	8.4	9.1	9.8	10.5	11.2	12.	12.7	13.	14.1	14.8	15.6	16.3
20″	8.2	9.	9.8	10.5	11.3	12.1	12.9	13.7	14.5	15.2	16.	16.8	17.5
22″	8.8	9.6	10.4	11.2	12.1	13.	13.8	14.6	15.4	16.2	17.	17.8	18.8
24″	9.4	10.3	11.1	12.	12.9	13.8	14.7	15.6	16.5	17.4	18.3	19.2	20.
26″	10.	10.9	11.8	12.7	13.7	14.7	15.6	16.6	17.5	18.5	19.4	20.4	21.3
27½″	10.4	11.4	12.5	13.4	14.3	15.3	16.3	17.3	18.3	19.3	20.3	21.3	22.2
28″	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5
30″	11.1	12.2	13.2	14.3	15.4	16.4	17.5	18.5	19.6	20.6	21.7	22.7	23.8
32″	11.7	12.8	13.9	15.	16.1	17.2	18.4	19.5	20.9	21.7	22.8	23.9	25.
34″	12.3	13.5	14.6	15.8	17.	18.1	19.3	20.5	21.6	22.9	24.	25.2	26.3
36″	12.9	14.1	15.3	16.5	17.8	19.	20.9	21.4	22.7	23.9	25.1	26.3	27.5
38″	13.5	14.7	16.	17.3	18.6	19.9	21.1	22.4	23.7	25.	26.2	27.5	28.9
40″	14.	15.4	16.7	18.	19.4	20.7	21.6	23.4	24.7	26.	27.4	28.7	30.
44″	15.2	16.7	18.1	19.5	21.	22.4	23.9	25.3	26.8	28.2	29.7	31.1	32.5
48″	16.4	17.9	19.5	21.	22.6	24.2	25.7	27.3	28.8	30.4	31.9	33.5	35.

Sizes not shown, figure brick opening.



Sump Pumps

AMERICAN-MARSH

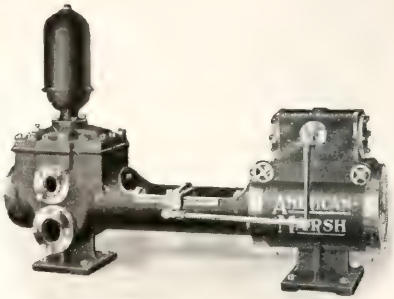
Steam and Power Pumps

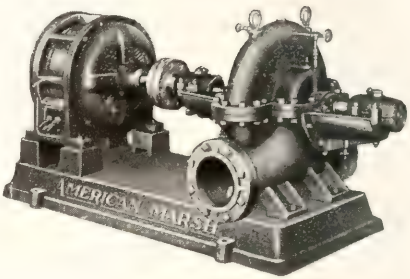
Centrifugal Pumps

Air Compressors

Condensation Heating Pumps

Vacuum Heating Pumps





AMERICAN STEAM PUMP CO.
J. M. STANNARD, Mgr.
CHICAGO
925-928 Monadnock Tel. Harrison 2300

Send for No. 19 Catalogue

The Jennings-Nash Vacuum Heating Pump

Direct Connected to Electric Motor for Return Line Heating System

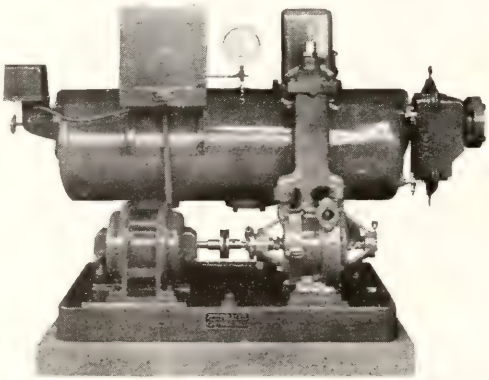
USE THE BEST AND AVOID TROUBLE

Complete Vacuum and Low Pressure Boiler Feed Pumping Units

Economical

Very Efficient

Bronze Fitted Throughout



Economy of Space

Silent Operation with no Contact Points inside of Pump Casing, Hence Long Life

Send for Bulletin No. 15

Thousands of the Largest and Best Office Buildings, Hotels, Institutions, Schools, and Manufacturing Plants are fitted up with the Jennings-Nash Heating Units.

STANNARD POWER EQUIPMENT CO.

925-928 MONADNOCK BLOCK Telephone: Harrison 2300 CHICAGO, ILL.

TABLE OF COMPARATIVE RATINGS AS COMPILED BY THE CHICAGO MASTER STEAMFITTERS ASSOCIATION

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900
1		135	134	134	133	133	133	132	132	131	131	130	130	130	129	129	128	128	127	127	127	126	126	125	125	125	124	124	123	123	122
2		130	129	129	128	128	128	127	127	126	126	125	125	125	124	124	123	123	122	122	122	121	121	120	120	120	119	119	118	118	117
3		125	124	124	123	123	123	122	122	121	121	120	120	120	119	119	118	118	117	117	117	116	116	115	115	115	114	114	113	113	112
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		100	.995	.99	.985	.983	.98	.975	.97	.965	.963	.958	.953	.95	.945	.94	.938	.933	.928	.925	.92	.915	.913	.908	.903	.90	.895	.89	.887	.883	.878
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.80	.798	.796	.794	.79	.785	.783	.779	.775	.773	.77	.768	.763	.76	.758	.753	.75	.748	.745	.743	.738	.735	.733	.729	.725	.723	.72	.717	.713	.71
8		.75	.745	.74	.735	.73	.725	.72	.715	.71	.705	.70	.695	.69	.685	.68	.675	.67	.665	.66	.655	.65	.645	.64	.635	.63	.625	.62	.615	.61	.605
9		.65	.645	.64	.635	.63	.625	.62	.615	.61	.605	.60	.595	.59	.585	.58	.575	.57	.565	.56	.555	.55	.545	.54	.535	.53	.525	.52	.515	.51	.505
10		.50	.498	.495	.493	.49	.488	.485	.483	.48	.478	.475	.473	.47	.468	.465	.463	.46	.458	.453	.45	.448	.443	.44	.438	.435	.433	.43	.428	.425	.423
11		.45	.448	.445	.443	.44	.438	.435	.433	.43	.428	.425	.423	.42	.418	.415	.413	.41	.408	.403	.40	.398	.393	.39	.388	.385	.383	.38	.378	.375	.373
12		.40	.398	.397	.395	.394	.393	.391	.39	.388	.387	.385	.384	.383	.381	.38	.378	.377	.375	.374	.373	.37	.368	.367	.365	.364	.363	.361	.36	.358	.357
13		.35	.348	.347	.345	.344	.343	.341	.34	.338	.337	.335	.334	.333	.331	.33	.328	.327	.325	.324	.323	.32	.318	.317	.315	.314	.313	.311	.31	.308	.307
14		.30	.298	.297	.295	.294	.293	.291	.29	.288	.287	.285	.284	.283	.281	.28	.278	.277	.275	.274	.273	.27	.268	.267	.265	.264	.263	.261	.26	.258	.257

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900
1		122	122	121	121	120	120	120	119	119	118	118	117	117	117	116	116	115	115	114	114	114	113	113	112	112	112	111	111	110	110
2		117	117	116	116	115	115	115	114	114	113	113	112	112	112	111	111	110	110	109	109	109	108	108	107	107	107	106	106	105	105
3		112	112	111	111	110	110	110	109	109	108	108	107	107	107	106	106	105	105	104	104	104	103	103	102	102	102	101	101	100	100
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		.875	.87	.865	.863	.858	.855	.85	.845	.84	.837	.832	.828	.825	.82	.815	.81	.808	.803	.798	.795	.79	.787	.783	.778	.773	.77	.765	.76	.758	.753
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.707	.703	.70	.698	.694	.691	.688	.685	.682	.678	.675	.673	.669	.665	.663	.659	.657	.655	.65	.648	.643	.64	.638	.634	.63	.628	.625	.623	.619	.615
8		.60	.598	.596	.595	.593	.592	.59	.588	.587	.586	.585	.583	.581	.58	.579	.577	.575	.574	.573	.571	.57	.568	.566	.565	.564	.562	.56	.559	.558	.555
9		.50	.498	.496	.495	.493	.492	.49	.488	.487	.486	.485	.483	.481	.48	.479	.477	.475	.474	.473	.471	.47	.468	.466	.465	.464	.462	.46	.459	.458	.455
10		.42	.418	.415	.413	.41	.408	.405	.403	.40	.398	.395	.393	.39	.388	.385	.383	.38	.378	.375	.373	.37	.368	.365	.363	.36	.358	.355	.353	.35	.348
11		.37	.368	.365	.363	.35	.358	.355	.353	.35	.348	.345	.343	.34	.338	.335	.333	.33	.328	.325	.323	.32	.318	.315	.313	.31	.308	.305	.303	.30	.298
12		.355	.354	.353	.351	.35	.348	.347	.345	.343	.341	.34	.338	.337	.335	.334	.333	.331	.33	.328	.327	.325	.324	.323	.321	.32	.318	.317	.315	.314	.313
13		.305	.304	.303	.301	.30	.298	.297	.295	.293	.291	.29	.288	.287	.285	.284	.283	.281	.28	.278	.277	.275	.274	.273	.271	.27	.268	.267	.265	.264	.263
14		.255	.254	.253	.251	.25	.248	.247	.245	.243	.241	.24	.238	.237	.235	.234	.233	.231	.23	.228	.227	.225	.224	.223	.221	.22	.218	.217	.215	.214	.213

NOTE—No boiler to be installed having grate longer than 72"

WASTE DISPOSAL
GODER
FURNACES

The Service we are rendering to others is our best recommendation to you

GODER INCINERATORS

Chimney-Fed and Direct Feed Types

Solve any Garbage Problem for New Buildings and Old

Sizes from 7 bushels capacity to 300 tons
Natural and Forced Draft

For Apartments, Hotels, Office Buildings, Hospitals, Factories Municipalities, Grain Elevators, Warehouses and any other industrial plants

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U. S. Mail Terminal, Chicago
Sisson Hotel, Chicago
Hotels Windemere, Chicago
American Examiner Garage, Chicago
Hupp Motor Car Co., Detroit, Mich.
Illinois Felt Co., Chicago.
Eastern Market, Detroit, Mich., *2 installations*
Northern Central Elevator, Penn. R. R., Baltimore
U. S. Naval Hospital, Great Lakes, Ill., *2 installations*
Louisville Bedding Co., Louisville, Ky., *3 installations*
Reyland Apartments, Chicago
Municipal Receiving Hospital, Detroit, Mich.
Navy Yards Hospital, Charleston, S. C.
Healthwin Tuberculosis Sanitarium, South Bend, Ind.
Ford Hospital, *3 installations*, Detroit, Mich.

Goder Incinerators are specified by the leading Architects. You will find in our catalogues the Incinerator most suitable for your:

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Bank Bldg.

Store Bldg.
Warehouse
Factory Bldg.
Grain Elevators
Park and Playground

Send for Detailed Description

GODER INCINERATOR CORPORATION

323 North Michigan Avenue

CHICAGO

Telephone: Central 1444

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9200	9400	9600	9800	10000	10200	10400	10600	10800
1		110	109	109	108	108	107	107	107	106	106	105	105	104	104	104	103	103	102	102	101	101	101	100	100	997	993	99	988	986	985
2		105	104	104	103	103	102	102	102	101	101	100	100	999	993	99	985	98	975	973	969	965	96	955	95	947	943	94	938	936	935
3		100	995	99	98	98	978	973	97	965	96	955	951	949	943	94	935	93	925	923	919	915	91	905	90	897	893	89	888	886	885
4		.92	92	92	92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
5		.75	745	74	735	73	728	723	.72	715	.71	705	701	699	693	.69	685	.68	675	673	669	665	.66	655	.65	647	643	.64	638	636	635
6		.68	68	68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.613	608	606	603	.60	596	593	.59	586	583	.58	578	574	.57	568	563	561	558	555	551	548	545	542	539	536	533	531	.53	528	526
8		554	552	55	549	548	547	546	545	543	541	.54	538	536	535	533	531	.53	529	527	525	524	523	.52	519	517	516	515	515	514	513
9		454	452	45	449	448	447	446	445	443	441	.44	438	436	435	433	431	.43	429	427	425	424	423	.42	419	417	418	375	.37	365	.36
10		345	343	34	338	335	333	.33	328	325	323	.32	318	315	313	31	305	.30	298	295	293	.29	289	288	286	285	278	276	275	274	273
11		295	293	29	288	285	283	.28	278	275	273	.27	268	265	263	.26	255	.25	248	245	243	.24	239	238	236	235	228	226	225	224	223
12		306	304	303	301	299	298	296	295	293	292	.29	289	287	285	283	282	.28	279	277	275	274	273	271	.27	269	266	265	264	264	263
13		256	254	253	251	249	248	246	245	243	242	.24	239	237	235	233	232	.23	229	227	225	224	223	221	.22	219	216	215	214	214	213
14		206	204	203	201	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	11000	11200	11400	11600	11800	12000	12200	12400	12600	12800	13000	13200	13400	13600	13800	14000	and Over	×
1		983	98	978	975	973	971	97	968	965	963	962	958	956	955	953	95	95	50%
2		933	93	928	925	923	921	92	918	915	913	912	908	906	905	903	90	90	50%
3		833	88	878	875	873	871	87	868	865	863	862	858	856	855	853	85	85	50%
4		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	50%
5		633	63	628	625	623	621	62	618	615	613	612	608	606	605	603	60	60	40%
6		68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	40%
7		525	523	522	52	518	516	515	513	512	51	508	507	506	505	503	50	50	25%
8		512	512	511	51	509	508	507	506	505	505	504	503	503	502	501	50	50	25%
9		355	35	345	30	30	29	264	261	26	259	258	256	255	253	251	25	25	15%
10		27	269	268	267	266	265	264	261	26	259	258	256	255	253	251	25	25	15%
11		22	219	218	217	216	215	214	211	21	209	208	206	205	203	201	20	20	15%
12		262	261	26	26	259	258	257	256	256	255	255	254	253	252	251	25	25	15%
13		212	211	21	21	209	208	207	206	206	205	205	204	203	202	201	20	20	10%
14		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	10%

NOTE—No boiler to be installed having grate longer than 72".

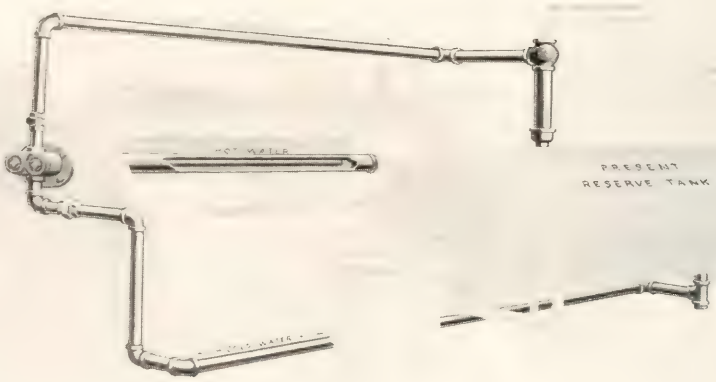
KEY FOR COMPUTING BOILER SIZES FOR RADIATION

As Compiled by The Chicago Master Steamfitters Association.

For computing minimum sizes of boilers for the average building based on approved ratings specified in the manufacturers' catalogue.

First reduce all radiation to the equivalent of cast iron column radiation, then use **KEY** applying to boilers and add factor of safety when buildings are heated from 10° to 70° F.

See page 545.



Practical · Economical · Efficient

"BST" Indirect system of Heating Water for domestic use.

"BST" Combines heating of water with the Steam Boiler.

Uses surplus Heat of banked fire at night.

Gives constant hot water at 50% less cost.

"BST" Requires no upkeep and is easily cleaned.

"BST" Heaters are submerged in hot water of steam heating boiler, with pipe connections to the Hot Water Storage Tank and Water Supply.

"BST" Heaters are constructed of Copper heating tubes with closed end and contain a removable inner tube of Brass Tubing.

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Loewenberg & Loewenberg

Manufactured and Installed by

Ferguson & Lange Foundry Co.

1039 Willow Street, Chicago

Telephone Lincoln 5575

KEY FOR COMPUTING BOILER SIZES FOR DIRECT RADIATION

Compiled by the Standardization Committee of the CHICAGO MASTER STEAM FITTERS' ASSN.
(Copyrighted, 1923)

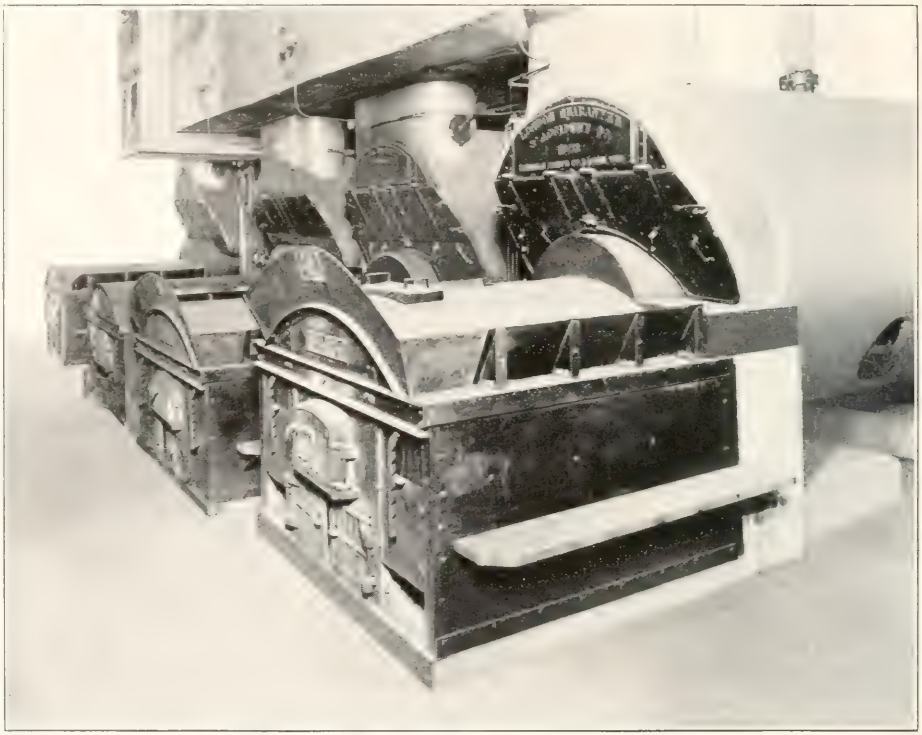
Key	Manufacture	Trade Name	Catalogue
3	American Radiator Co.	Arco Round	April 1, 1922
5	American Radiator Co.	Ideal Sectional	April 1, 1922
5	American Radiator Co.	Type T 23", 29", 36", 48", Without Arch	April, 1, 1922
7	American Radiator Co.	Type T 23", 29", 36", 48", With Arch	April, 1, 1922
7	American Radiator Co.	Type T 79"	August, 1923
5	American Radiator Co.	Type A	1925
0	Burnham Boiler Corporation	Round 150% on all sizes	No. 62
5	Burnham Boiler Corporation	Square Sectional	No. 62
5	Continental Heater Corporation	Cont-Bernhard Up-draft and Smokeless.	
5	Cox Abram Stove Co.	Novelty Round	No. 76 A
5	Cox Abram Stove Co.	Novelty Square	No. 76 A
5	Cox Abram Stove Co.	Novelty Smokeless	No. 76 A
5	Harrisburg Star Boiler Co.	Harrisburg Star Water Tube.	
5	Hart & Crouse Co.	Royal Round Boiler.	
5	Hart & Crouse Co.	Royal Sectional Boiler.	
5	Hart & Crouse Co.	Royal Header Type.	
3	Hart & Crouse Co.	H & C Down-draft Series 24".	
10	Hart & Crouse Co.	H & C Down-draft Series 33-40-55".	
	Note—Series 24-33-40-55" ratings are 4 times pounds of condensation as shown in catalogue number 1723.		
5	Herbert Boiler Co.	Junior All Steel Boilers	1923
7	Herbert Boiler Co.	Portable Down-draft, Portable Direct Draft	1923
10	Herbert Boiler Co.	Brick-set Down-draft	1923
12	Herbert Boiler Co.	B. Series	1923
5	Ideal Furnace Co.	Radiant Round Boiler.	
5	Ideal Furnace Co.	Radiant Square Boiler.	
7	Ideal Furnace Co.	Radiant Smokeless Boiler.	
5	Illinois Malleable Iron Co.	Imico Illinois Round	1916
5	Illinois Malleable Iron Co.	Imico Sectional	1916
7	Illinois Malleable Iron Co.	Imico Smokeless	1916
4	International Heater Co.	Economy Round Boiler	February, 1924
7	International Heater Co.	Economy Sectional Boiler	February, 1924
5	International Heater Co.	Economy Smokeless Boiler	1923
3	Kellogg-Mackay Co.	Pebco Round.	
5	Kellogg-Mackay Co.	American Up-draft.	
7	Kellogg-Mackay Co.	American Smokeless.	
8	Kellogg-Mackay Co.	Pierce Magazine.	
14	Kewanee Boiler Co.	All Types of Boilers	Cat. 78
1	Mueller, L. G., Furnace Co.	Mueller Round	1922
5	Mueller, L. G., Furnace Co.	Mueller Sectional	1922
1	Monroe Frdy. & Furnace Co.	Floral City Boiler	Cat. 26
0	National Rad. Co.	Acme Round Boiler 150% on all Sizes	No. 32
3	National Rad. Co.	Novus Boiler	No. 32
5	National Rad. Co.	National Up-draft	No. 32
5	National Rad. Co.	National Smokeless	No. 32
8	Newport Boiler Co.	Newport Magazine	1920
3	Niagara Rad. & Boiler Co.	Niagara 1920 Round.	
7	Niagara Rad. & Boiler Co.	Niagara Smokeless	1922
14	Oil City Boiler Works	All Types of Boilers	No. 9
9	Pacific Boiler Sales Corp.	Pacific Smokeless	S. C. 25
10	Pacific Boiler Sales Corp.	Pacific Direct Draft	S. C. 25
9	Pacific Boiler Sales Corp.	Pacific Down Draft	S. C. 25
1	Page, Wm. H., Boiler Co.	Volunteer Round	ca. 50
5	Page, Wm. H., Boiler Co.	Square Sectional with Arch	ca. 50
5	Page, Wm. H., Boiler Co.	Square Sectional without Arch	ca. 50
5	Page, Wm. H., Boiler Co.	Square Sectional Down Draft	ca. 50
3	Peerless Heater Co.	Peerless Round	1923
5	Peerless Heater Co.	Peerless Sectional U. D.	1923
5	Peerless Heater Co.	Peerless Smokeless	1923
5	Richardson & Boynton Co.	Round Boiler	No. 203
5	Richardson & Boynton Co.	Sectional Up-draft	No. 203
7	Richardson & Boynton Co.	Smokeless Boiler	1922
2	Richmond Radiator Co.	Riraco Boiler	100
2	Richmond Radiator Co.	Round Boiler	100
5	Richmond Radiator Co.	Sectional Up-draft	100
5	Richmond Radiator Co.	Model Boiler	100
8	Richmond Radiator Co.	Magazine Smokeless	100
9	Ross Boiler Co.	Portable	3 A
9	Simplex Boiler Co.	Portable Smokeless.	
8	Standard Water Co.	Spencer Magazine Boiler	18
5	Thatcher Furnace Co.	Round Boiler	1923
5	Thatcher Furnace Co.	Sectional Boiler	1923
5	Thatcher Furnace Co.	Progress Boiler	1923
14	Titusville Iron Wks. Co.	All Types of Boilers	81
1	Union Radiator Co.	Union Round.	
5	Union Radiator Co.	Square Sectional.	
2	United States Rad. Corp.	Capitol Winchester	1922
5	United States Rad. Corp.	Capitol Sectional	1922
5	United States Rad. Corp.	Semi-smokeless	1922
7	United States Rad. Corp.	Capitol Smokeless	1922
5	Utica Heater Co.	Square Up-draft.	
7	Utica Heater Co.	Imperial Smokeless.	
1	Weil McLain Co.	Round Boiler	1923
5	Weil McLain Co.	Sectional Up-draft	1923
7	Weil McLain Co.	Smokeless	1923
5	All Artificial Gas Fired Boiler.		

Note—No change in boiler factors will be made by installing oil burners.

FREEMAN MFG. CO.

RACINE, WIS.

Chicago Office, 331 Monadnock Building



BOILER ROOM, LONDON GUARANTEE BUILDING.
700 HORSE POWER FREEMAN INTERNAL FURNACE BOILERS WITH SMOKELESS FURNACES

Similar installations will be found in

THE CHICAGO TEMPLE
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THE UNIVERSITY CLUB
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The above buildings are a few of hundreds in Chicago where FREEMAN BOILERS are installed

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55 YEARS IN THE BUSINESS
LARGEST AND BEST EQUIPPED BOILER SHOP IN THE WEST

MINIMUM HEAD ROOM REQUIREMENTS FOR SMOKELESS SETTINGS.

BOILERS

	Furnaces	Horizontal Return Tubular				Water Tube				Scotch Marine
		54"	60"	66"	72"	Hor. Baff. 1"-1½" Pitch	Vert Baff 1"-1½" Pitch	Hor Baff 3¼" Pitch	Vert Baff 3¼" Pitch	
		Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Front Head down to Floor				
Hand Fired	No. 6	32"	34"	34"	36"	**6'0"	*	**6'6"	*	**
	No. 7 (Modified)	32"	34"	34"	36"	=	=	=	=	**
	No. 8	32"	34"	34"	36"	6'0"	*	6'6"	*	**
	Hand Stoker	26"	28"	28"	30"	5'6"	*	6'0"	*	Full Extension
		Shell to Floor	Shell to Floor	Shell to Floor	Shell to Floor					
	Down Draft	60"	60"	60"	60"	6'0"	*	6'6"	*	Full Extension
	Twin Fire	58"	60"	62"	64"	6'0"	*	6'6"	*	*
	Semi Ext Refuse Burning	44"	46"	46"	48"	7'0"	*	7'6"	*	*
Gravity Feed	Burke	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
	McMillan	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
	Twin Fire (Gravity)	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
	Chain Grates	72"	72"	78"	78"	7'0"	9'0"	8'0"	10'0"	**
Front Feed	Moore	48"	54"	60"	60"	6'0"	8'6"	6'6"	9'0"	**
	Roney	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	**
	Wetzel	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	**
Side Feed	Detroit	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
	Model	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
	McKenzie	66"	70"	70"	70"	7'6"	*	8'0"	*	Full Extension
	Murphy	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
Underfeed	Type "E"	**	**	**	**	6'6"	8'6"	7'6"	9'0"	**
	Jones	36"	38"	40"	42"	6'0"	8'0"	7'0"	8'6"	Min Diam. Furnace 36"
	Detroit	42"	44"	46"	48"	6'6"	8'6"	7'6"	9'0"	
	Taylor	**	**	**	**	6'6"	8'6"	7'6"	9'0"	**
	Sanford-Riley	**	**	**	**	6'6"	8'6"	7'6"	9'0"	**
	Westinghouse	**	**	**	**	6'6"	8'6"	7'6"	9'0"	**

NOTES

* Combinations not recommended as smokeless settings
= Not adapted to water tube boilers.
** Combinations not ordinarily met with in practice
** Omit double arches—using only deflection arch.
Setting heights for Jones stoker refer to standard stoker

The accompanying table is intended to show the minimum setting heights for the various combinations of boilers and furnaces found in use in Chicago.

These settings are not intended for high capacities, but have proven satisfactory for normal loads where draft is sufficient and proper methods of operation used.

The setting heights shown for side feed stokers are for furnace widths of 7' 0" or less. For wider furnaces the heights must be increased to allow for increased arch spring necessitated by the wider span.

Combinations of vertically baffled water tube boilers noted as not being recommended as smokless settings have been found in actual operation to produce too much smoke to comply with the smoke ordinance in its strictest interpretation, and have proven unsatisfactory from the Smoke Inspector's viewpoint.

A BIRDS EYE VIEW
OF WHAT THE HARDINGE OIL BURNER WILL DO

MANUFACTURED BY

HARDINGE BROS. INC.

CHICAGO ILL. - U.S.A.

SECTIONS OF THE SANITARY CODE OF INTEREST TO ARCHITECTS, WITH INDEX

Sections of the Building Ordinance pertaining to Sanitary and Health Departments are not included in these sections and may be found by referring to the Index to the Building Ordinance.

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BAKERIES AND BREAD.

295.—Bakery defined.] Any establishment, place, wagon or stand used for the manufacture of bread, buns, rolls, biscuits, cakes, crackers, matzos, pretzels, pastry, doughnuts, waffles, noodles, macaroni, spaghetti or ice cream cones, or any establishment used for the process of mixing, compounding or baking of any food product of which flour or meal is a principal ingredient, for sale to the public, or for the purpose of a restaurant, bakery, hotel, commissary or catering establishment, shall be deemed a bakery for the purpose of this article; provided, that a licensed restaurant in which any of the foregoing food products are mixed and baked for consumption in such restaurant only, or in ordinary restaurant kitchen stoves or ranges, shall not be considered a bakery.

300. Sanitary requirements—ventilation.] Every place used as a bakery shall be kept in a clean and sanitary condition as to its floors, side walls, ceilings, woodwork, fixtures, furniture tools, machinery and utensils. All

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CHICAGO

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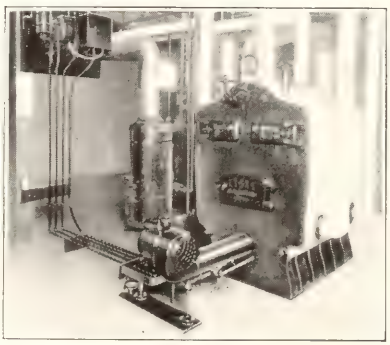
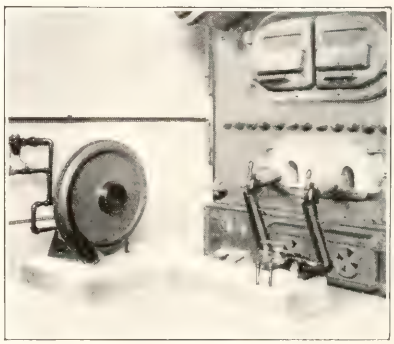


KLEEN-HEET



WINSLOW

parts of the bakery shall be adequately lighted at all times and shall be ventilated by means of windows or skylights or air shafts or air ducts or mechanical apparatus, if necessary, so as to insure a free circulation of fresh air all times. Such ventilating construction and equipment shall be of such character that a complete change of air in all parts of the bakery may be made at least four times each hour; provided, however, that it shall not be necessary to ventilate at such time or in such manner that the process of mixing or rising of dough shall of necessity be interfered with or prevented.

301. Floor—how constructed.] The floor of every place used as a bakery, if below the street level, shall be constructed of concrete, cement, asphalt or other impervious material, or of tile laid in cement, which floor may, if desired, be covered with a hardwood floor having tight joints; if above the street level, the floor may be of hardwood with tight joints or may be of any impervious material, as above provided. The angles where the floor and wall join shall be made and maintained so as to be rat-proof.

303. Walls and ceilings—woodwork.] The side walls and ceiligs shall be well and smoothly plastered, tiled or sheathed with metal or wood sheathing, and shall be kept in good repair. If made of mill construction with smooth surfaces, such walls and ceilings need not be sheathed or plastered. All walls and ceilings shall be kept well painted with oil paint, or lime washed and calcimined, and all woodwork shall be kept well painted with oil paint.

304. Plumbing and drainage facilities.—water closets and sinks.] Every such bakery shall be provided with adequate plumbing and drainage facilities, including well ventilated water closets and impermeable wash sinks on iron supports.

Amended January 2, 1924.

305. Sleeping facilities—domestic animals, except cats, prohibited.] No person shall sleep in any bakery, or in the rooms where flour or meal used in connection therewith, or the food products made therein, are handled or stored. If any sleeping places are located on the same floor as the bakery, they shall be well ventilated, dry and sanitary. No domestic animals, except cats, shall be permitted in a bakery or place where flour or meal is stored in connection therewith, and suitable provision shall be made to prevent nuisances from the presence of cats.

309. Storage of materials and food.] All rooms for the storage of flour or meal for use in connection with any bakery shall be dry and well ventilated, and every bakery and room used for the storage of materials and food products in connection therewith shall be so arranged that the shelves, cupboards, trays, troughs, bins, cases and all other appliances for handling and storing same can be easily removed and cleaned. If the floor of any such bakery or room is below the adjacent street level, no such materials or products shall be stored nearer to such floor than one foot.

311. New bakeries — requirements.] No new bakery shall be hereafter established in any room, basement or cellar in which the clear height between the finished floor and ceiling is less than eight feet six inches or in any room or place, the floor of which is more than five feet below the street, sidewalk or alley level adjacent to the building, or in any room or place which is not so naturally lighted by means of windows, doors or skylights that on clear days a book or paper printed with long primer type can be read between the hours of ten o'clock a. m. and two o'clock p. m. in all parts of the bakery which are used in mixing or handling bakery products; provided, however, that where a bakery is to be installed for the purposes of a restaurant operated in connection with a railway passenger terminal, in case the plans for such bakery shall in all other respects comply with the ordinances of the City and such special requirements as the Commissioner of Health shall deem necessary with respect to its sanitary features and shall be approved by said commissioner, the said provisions shall not apply.

If any new bakery hereafter established has its floor above, at, or not more than three feet below the adjacent street or alley level, no window opening by which it is ventilated shall be less than three feet above such street or alley level; if the floor of any such bakery is more than three feet below the adjacent street or alley level, no such window opening shall be less than eighteen inches above such street or alley level.

Amended January 2, 1924.

312. Bakery discontinued for six months and reopened — how considered.] If any bakery which is now being maintained and operated shall be vacated, discontinued or unused for a period of more than six consecutive months and shall thereafter be reopened and re-established as a bakery, such bakery shall be considered a new bakery for purposes of this chapter.

DRAINS, SEWERS AND GRADES.

1085. Work on tile drains inside building line—outside building line—by whom approved and supervised.] All work done by licensed drain layers on drains or pipes inside any building or structure, and all work done on any catch basin or cesspool located on or in any private premises, shall be done according to plans approved by the commissioner of health, and under the supervision and to the satisfaction and approval of the commissioner of public works; and no such work shall be done except on a permit in writing issued by said commissioner of public works.

All work done by licensed drain layers on drains or pipes outside any building or structure or upon any street, alley, or public way, shall be done under the supervision and to the satisfaction and approval of the commissioner of public works; and no such work shall be done except on a permit in writing issued by said commissioner.

1086. Inspection of work.] All work done by licensed drain layers, other than work done on local improvements paid for wholly or in part by special assessment while such work is under the supervision and control of the board of local improvements, shall be subject to the inspection, supervision and approval of the commissioner of public works; and any faulty or defective work done by any licensed drain layer which may at any time be discovered by him shall be made satisfactory to said commissioner.

Any licensed drain layer who shall neglect, refuse or fail to make good any defects or faults in his work which shall be discovered by said commissioner, shall not be permitted to do any further or additional work as a drain layer until the defects or faults so discovered have been made good in a manner satisfactory to the commissioner of public works; and any licensed drain layer who shall refuse, neglect or fail to make good such defects or faults, when requested so to do by said commissioner, or who shall otherwise violate or fail to comply with any of the provisions of this article or any rule or regulation of the department of public works governing or regulating the business of drain laying, shall have his license revoked by the mayor upon the recommendation of said commissioner, and shall not again be permitted to conduct, carry on, or engage in, the business of drain laying until satisfactory assurance shall be given to the mayor that such person will thereafter faithfully observe the ordinances of the city and the rules and regulations of the department of public works and until such drain layer shall have made good any loss, damage or expense caused by or on account of any negligence or misconduct on his part which was the cause of the revocation of his license.

NO ADDITIONAL RADIATION IS NECESSARY

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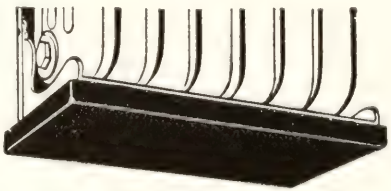
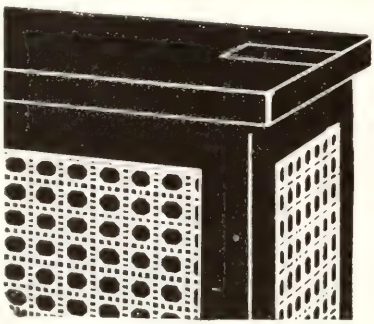
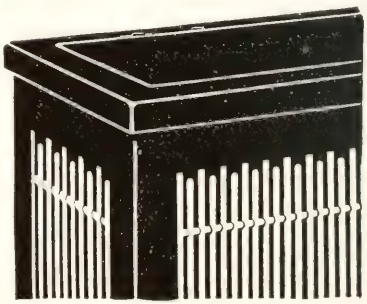


Standard

Six Coats of Enamel—BAKED ON



Cane Grille



Rod Grille

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Art Metal Radiator Cover Co.

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1087. Renewal of license.] Any person licensed as a drain layer shall be entitled to have his license renewed without filing application, upon payment by him of the license fee of twenty-five dollars and the renewal of the bond hereinabove provided for.

1088. Penalty.] Any person, firm or corporation violating or failing to comply with any of the provisions of this article shall be fined not less than five dollars nor more than one hundred dollars for each offense.

ARTICLE II.

PUBLIC SEWERS AND DRAINS.

1092. Catch basins—removal of contents.] The contents of catch basins in public streets shall be removed by means of vehicles having boxes made of steel or iron, which boxes shall be not less than eighty cubic feet nor more than one hundred cubic feet in capacity.

ARTICLE III.

MISCELLANEOUS PROVISIONS.

1093. Steam—discharge in sewer prohibited.] No person shall make or use or cause to be made or used any connection with or opening into any sewer or drain for the conveyance or discharge into such sewer or drain of steam from any steam boiler or engine, or from any manufactory building in which steam is either generated or used, under a penalty of fifty dollars for each and every day during any part of which such connection or opening may have been used for that purpose.

1094. Obstructing sewer — penalty.] No grease, fatty matter, butcher's offal or garbage, dead animals, stone dust or other waste, causing obstructions, or wastes destructive of masonry or obstructions of any kind whatsoever shall be placed, thrown or deposited in any receiving basin, manhole, sewer or waterway; and any person, firm or corporation so offending or causing any such obstruction or substance to be so placed so as to be carried or delivered into such basin, manhole, sewer or waterway, shall be subject to a penalty of ten dollars for each offense; and any person, firm or corporation injuring, breaking, or removing any portion of any receiving basin, covering flag, manhole, vent or drain shall be subject to a penalty of twenty dollars for each offense; nor shall any quantity of marble or other stone, iron, lead, timber or any other substance, exceeding one ton in weight, be placed or deposited upon any wharf or bulkhead through which any sewer or drain may run; nor upon or over any sewer or drain where the same shall be within three feet of the surface of the street, under a penalty of not more than fifty dollars for each offense, to be recovered of the person, firm or corporation causing or permitting the same.

1095. Excavation around sewer—permit.] Any person who shall uncover or excavate under or around any public sewer in this city, for any purpose whatever, without the written consent of the commissioner of public works, shall be fined not less than ten dollars and not more than fifty dollars for each offense.

1096. Alteration of house drain.] Any person who shall lay, alter or disturb any part of a house drain or drains, catch basin or strainer of such drain or drains, cesspool or water closet, connecting with any public sewer belonging to said city, without being duly licensed to perform the same by said commissioner, shall be fined not less than ten dollars and not more than fifty dollars for each offense.

1097. Plans for buildings—not to be approved unless land is provided with adequate drains.] No plans shall be approved and no permit shall hereafter be issued by the commissioner of buildings for the construction, enlargement, altering, repair or removal of any building on any tract, lot or parcel of land, unless such tract, lot or parcel of land shall be provided with adequate drains connecting with or emptying into a public drain or sewer in accordance with the general ordinances of the city or unless proceedings shall have been instituted to provide such drain or sewer.

1098. Drain construction.] It shall be the duty of any person constructing or using any private drain, sewer, cesspool, water closet pipe or other pipe connecting with or emptying into any public drain or sewer belonging to said city, to construct and use the same strictly in conformity with the orders and directions of the commissioner of public works and the commissioner of health, or either of them, and any person who shall construct or use, or cause to be constructed or used, any such drain, sewer, cesspool or water closet pipe in a different manner from that so ordered and directed by one or both of said commissioners, shall be fined not exceeding fifty dollars for each offense.

1099. Inspection—right of entry.] That the public drains and sewers of the city may be fully protected against improper use and injury, the commissioner of public works and his authorized agents shall have free and unobstructed access to any part of any premises where house drains, cesspools or water closets, connected with or draining into such drains or sewers, are laid, for the purpose of examining the construction, condition and usage of the same, and making necessary alterations or repairs, at any time of the day between the hours of seven o'clock a. m. and six o'clock p. m.; and any owner, occupant or other person, refusing to allow any officer or agent of said commissioner access to the premises for such purposes, shall be fined not less than five dollars nor exceeding fifty dollars for each offense.

HOSPITALS.

1850. Hospital defined.] For the purpose of this article a hospital is hereby defined to mean any institution or place used for the harboring or the reception, care and treatment (including treatments known as rest cure, physical culture, hydropathic massage and all other forms of drugless treatment) of two or more persons suffering from or afflicted with any mental or physical disease, bodily injury, alcohol or drug addiction; or any institution or place for the reception and care, temporary or continuous, of one or more women during pregnancy while awaiting confinement, during confinement, or for one month or less after confinement, while recovering therefrom; or any place or establishment advertised, announced, conducted or maintained under the name "hospital" without a qualifying statement that such hospital is not intended for human beings.

1851. License required.] It shall be unlawful for any person, firm, association or corporation other than the regularly constituted authorities of the United States, the state of Illinois, the county of Cook, or the city of Chicago to open, conduct, manage or maintain any hospital as defined in this article within the corporate limits of the city of Chicago without first obtaining a license therefor as hereinafter provided.

1852. Application.] Any person, firm, association or corporation desiring such license shall make written application to the commissioner of health which shall conform to the general provisions of this ordinance relating to applications for licenses, and which shall also state the location or proposed location of the hospital, the purpose for which it is to be opened, conducted or maintained, the accommodations or proposed accommodations for the inmates thereof, the nature and kind of treatment given or proposed to be given therein, the name and address of the chief physician, surgeon or attending chief physician or surgeon or board of physicians or surgeons attendant therein.

1853. Hospital building.] The building or buildings used or to be used as a hospital shall comply with the requirements of the department of buildings and bureau of fire prevention and public safety.

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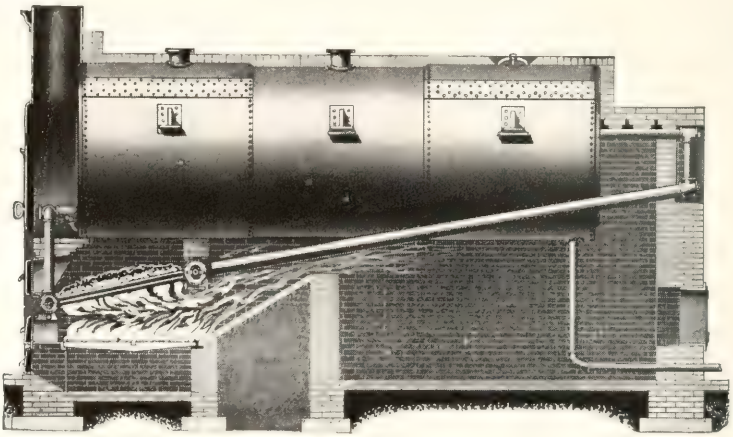
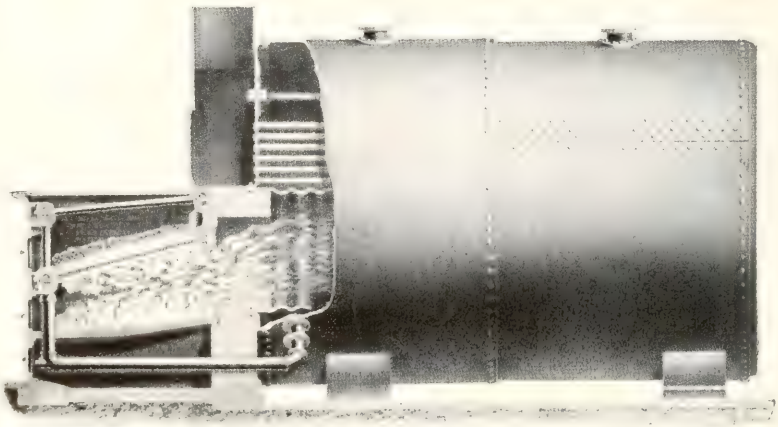


Can be attached to Return Tubular, Scotch Marine, or any type of Water Tube Boiler, for High or Low Pressure, New or Old Boilers.



1858. Hospital building board.] For the purposes of this ordinance there is hereby created a hospital building board, which shall be composed of the commissioner of health, the commissioner of buildings and the chief of fire prevention and public safety. The hospital building board shall meet upon call of the commissioner of health and shall make such recommendations to the city council as it may deem necessary or expedient for the construction and erection of new hospital buildings and for changes in buildings now being used or which may hereafter be used for hospital purposes.

1859. Accommodations for patients—regulations as to sanitation.] In every hospital licensed under the provisions of this article each room occupied or to be occupied by a patient or patients, shall be of such dimensions as shall give each adult patient not less than eight hundred cubic feet of space, babies up to six months old, two hundred cubic feet, children from six months to six years, three hundred cubic feet, six years to fourteen years, six hundred cubic feet, with fresh air and floor space in proportion. Every such room shall have at least one window connecting with the external air for each two beds. Said windows shall be of such dimensions as shall secure to each patient at least twenty-four hundred cubic feet of fresh air per hour by natural ventilation, or in case said window shall not secure said twenty-four hundred cubic feet of air per hour by natural ventilation then each room shall, in addition thereto, be fitted with such appliances for ventilation as shall secure to each patient in said room at least twenty-four hundred cubic feet of fresh air per hour. Each bed shall have at least eighty square feet of floor space. In case the same is a maternity hospital, a regularly licensed physician must reside on the premises. Each ward or wing in said hospital shall have running water furnished in one or more places either in said ward or convenient thereto, so that the same may be adequate and convenient to the occupants thereof. The plumbing, water closets, bath rooms and other sanitary appliances and equipment shall be constructed in accordance with the city ordinances relating thereto. The floor of the cellar or basement in any building used as a hospital shall be properly cemented so as to be water-tight. The halls of each floor shall be open to the external air, with suitable windows, and shall have no room or other obstruction at either end thereof, unless sufficient light or ventilation is otherwise provided for said hall, and the building as a whole shall be provided with adequate and proper fire escapes, stairways, or inclines for exits.

The doors, windows and other direct openings to the external air, of all hospitals, including the kitchen, dining rooms, laundry, toilet rooms, laboratory, morgue and post-mortem rooms of the same, shall be equipped from April 15th to November 15th with screens and appliances necessary for the exclusion of flies.

1862. Frontage consents required—when.] It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage, in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may face or extend, are devoted exclusively to residence purposes, any hospital, unless the owners of a majority of the frontage in such block, and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces or extends, consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for building or constructing any such hospital and before a license shall be issued for the maintaining, conducting or managing of such hospital.

1863. Location of hospital near school or playground.] No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for a public or parochial school or as a public playground.

ARTICLE XI.

HOMES.

1873. Home defined.] For the purpose of this article a home is hereby defined to mean any institution, place or family used for the reception or care, for a longer period than twenty-four hours, of three of more infants or children apart from their parents. A home is further defined to mean any institution used for the reception or care of persons who are dependent or not capable of properly caring for themselves, and shall be understood to include homes for the aged or infirm, orphan asylums, half-orphan asylums, refuges and shelters, and also boarding homes caring for three or more women with their children when such children are less than fourteen years of age.

1879. Accommodations for inmates—regulations as to sanitation.] In every such home each room occupied or to be occupied by inmates shall be of such dimensions as shall give each inmate not less than four hundred cubic feet of air space. Every such room shall have at least one window connecting with the external air for each four beds. Said windows shall be of such dimensions as shall secure to each inmate at least one thousand five hundred cubic feet of fresh air per hour by natural ventilation, or in case said window shall not secure said one thousand five hundred cubic feet of fresh air per hour by natural ventilation, then each room shall, in addition thereto, be fitted with such appliances for ventilation as shall secure to each inmate in said room at least one thousand five hundred cubic feet of fresh air per hour. Each bed shall have at least forty square feet of floor space, and in every room or dormitory containing more than one bed the beds shall be so arranged as to leave a passageway of not less than two feet horizontally on all sides of each bed.

Each ward or wing in said home shall have running water furnished in one or more places, either in said ward or convenient thereto so that the same may be adequate and convenient to occupants thereof. The plumbing, water-closets, bath-rooms and other sanitary appliances and equipment shall be constructed in accordance with the city ordinances relating thereto. The floor of the cellar or basement in any building used as a home shall be properly cemented so as to be water-tight.

The halls of each floor shall be open to the external air with suitable windows, and shall have no room or other obstruction at either end thereof, unless sufficient light or ventilation is otherwise provided for such halls, and the building as a whole shall be provided with adequate and proper fire escapes, stairways or inclines for exits.

All homes, including the culinary department, dining rooms, laundry, laboratory, morgue and post-mortem rooms connected with the same, shall be equipped from May 15th to November 15th with doors, screens and other appliances necessary for the exclusion of flies.

1881. Frontage consents required—when.] It shall be unlawful for any person, firm, association or corporation to build, construct, maintain, conduct or manage a home in any block in which two-thirds of the buildings fronting on both sides of the street or streets on or along which the proposed home may face are devoted exclusively to residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on or along which said building faces, consent in writing to the building, construction or

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maintaining, managing or conducting of any such home in such block; provided, however, that no new frontage consents shall be required if such home has heretofore been licensed by the city of Chicago as a hospital, home or nursery at the present location. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or constructing of any such home, and before a license shall be issued for the maintaining, conducting or managing of any such home.

UNDERTAKERS—BURIALS.

1902. Frontage consents.] It shall be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker as defined in this article, that receives, in connection with such business, at his or its place of business, the body of any dead person for embalming or other purposes, on or along any boulevard or pleasure driveway, without consent of a majority of the property owners according to the frontage on both sides of such boulevard or pleasure driveway in the block in which such morgue or place of business is located; it shall also be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in this article, that receives, in connection with such business, at his or its place of business the body of any dead person for embalming or other purposes, on or along any street in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided that nothing herein contained shall apply to such location in the case of any person licensed as an undertaker and authorized to carry on such business at any such location at the time of the passage of this ordinance, nor to any block in any street on which street cars are operated. Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

1903. Undertaking rooms.] No person shall be licensed to carry on the business of undertaking in any establishment, store or place, unless such establishment, store or place shall be provided with a compartment or room completely shut off or capable of being completely shut off from the other parts of such establishment, store or place; such compartment or room shall have free outside ventilation and light, and its floor shall be constructed of or covered with a non-absorbent material and shall be connected with a sewer by an approved sanitary drain.

1921. Undertaker's place not to be used as a public morgue.] No person licensed as an undertaker under the provisions of this article shall permit or allow any room, store, place or establishment conducted, used, operated or maintained by him in the undertaking business to be used as a public morgue. If any dead human body is brought to any such room, store, place or establishment, and if arrangements are not made for the burial or cremation of such body within one hundred hours from and after the hour of death, the body shall be taken by the undertaker to the Cook county morgue, or placed by him in one of the cemetery receiving vaults.

ARTICLE XXXI.

HEATING TENEMENT HOUSES, FACTORIES AND WORKSHOPS.

2119. Required temperature—complaints.] It shall be the duty of every person, firm or corporation owning or controlling the heating plant which furnishes heat to any tenement house, hotel, lodging house, rooming house or boarding house, as defined by the ordinances of the city, in which the heat is furnished from a heating plant used in common for the purpose of heating the various rooms and apartments therein, and such heating plant is under the control or supervision of such owner or person in control of such building, to furnish heat to such rooms and apartments from October 1st of each year to June 1st of the succeeding year, so that the occupants thereof may secure, without such undue restriction of ventilation as to interfere with proper sanitary conditions, a minimum temperature of 60 degrees Fahrenheit at 6:30 a. m., 65 degrees at 7:30 a. m., and 68 degrees at 8:30 a. m., and thereafter until 10:30 p. m., averaged throughout the apartment; provided, that written notice of complaint concerning lack of heat in such room or apartment shall first be given to such person, firm or corporation, owning or controlling such tenement house by registered mail before any person shall be deemed to have violated this section.

Amended January 2, 1924.

2120. Method of determining temperature. For the purpose of determining whether or not the temperature in any such room or apartment is in accordance with the provisions of the preceding section, temperature readings shall be made only by an inspector of the department of health by means of a standard Fahrenheit thermometer approved by the department of health in not less than two separate rooms in such apartment, or if the apartment consists of only one room then in two opposite parts of the room as near the extremes as practicable, such thermometer to be placed at a point not less than four feet nor more than six feet away from any door or window leading to the outer air. Failure to furnish the heat required in the preceding section shall not constitute an offense where it is due to a breakdown of the heating plant, if diligence is used to have such plant repaired (unless such breakdown has been caused by the violation of an existing ordinance relating to the operation of heating plants), nor where it is due to strikes, to general shortage of fuel, to any act of the tenant who makes the complaint, or to any cause beyond the owner's control, unless written notice of such failure to furnish the heat hereby required shall first have been given to the owner or agent of the building by registered mail, and the temperature readings herein provided for shall not be made until after the delivery of such registered letter to the addressee thereof.

Amended January 2, 1924.

2121. Required temperature in factories—moisture content.] It shall be the duty of every person firm or corporation owning or controlling the heating plant which furnishes heat to any factory or workshop as defined by this ordinance, to maintain a temperature within such factory or workshop of not less than 68 degrees Fahrenheit without such undue restriction of ventilation as to interfere with proper sanitary conditions therein; provided, however, that this requirement shall not apply to any factory or workshop where the business conducted therein is of such a nature that a higher or lower temperature than 68 degrees Fahrenheit is necessary or expedient for the work, trade, occupation or manufacturing processes of the business so conducted therein; and provided further, that in all such cases, when such higher or lower temperature is necessary or expedient, the moisture content of the air shall be increased where the temperature is maintained below 68 degrees Fahrenheit or decreased where the temperature is maintained above 68 degrees Fahrenheit in the proper amount to maintain a wet bulb temperature between 54 degrees and 58 degrees Fahrenheit, and in the case of special manufacturing processes where

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it is necessary or expedient to maintain a wet bulb temperature below or above the extremes herein set forth, the commissioner of health shall prescribe and enforce such reasonable precutions and safeguards as will meet the requirements of such special manufacturing processes without endangering the health of the occupants of such factory or workshops. The manner of determining the temperature in all cases where the temperature to be maintained is 68 degrees Fahrenheit shall be the same as in section 2120, and in all other cases shall be in such practical manner as in the commissioner of health may determine.

2121a. Required Temperatures in Offices Stores, and Places of Employment.] *It shall be the duty of any person, firm or corporation owning or controlling the heating plant which furnishes heat to any office, store or other place of employment, to maintain a temperature within such office, store or place of employment of not less than 68 degrees Fahrenheit without such undue restriction of ventilation as to interfere with proper sanitary conditions therein, between the hours of 8:00 A. M. and 6:00 P. M., from October first of each year to June first of the succeeding year, Sundays and full legal holidays excepted.*

2122. Penalty.] Any person, firm or corporation owning or controlling a tenement house, hotel, lodging house, rooming house or boarding house, as defined by the ordinances of the city in which the heat is furnished as described in section 2119, owning or controlling the heating plant which furnishes heat to any factory or workshop, office, store, or other place of employment as described in sections 2121 and 2121a, that violates any of the provisions of this article or neglects or refuses to comply therewith, after notice from the department of health as herein provided, shall, upon conviction thereof, be fined not less than twenty-five dollars nor more than two-hundred dollars for each offense, and a separate offense shall be deemed to have been committed each day that a violation of this article continues: provided, that no more than one fine shall be imposed for violations in the same building occurring on any one day.

ARTICLE XXXII.

DIVISION OF AIR CONDITIONS CONTROL.

2123. Division of air conditions control established in the department of health—duties.] There is hereby established a division of the department of health of the city of Chicago to be known and designated as the division of air conditions control. All employes in said division shall be appointed according to law and shall be under the supervision and control of the commissioner of health.

The division of air conditions control shall be charged with the inspection and control of the installation and maintenance of heating and ventilating equipment, the inspection of rooms for natural and mechanical ventilation, the prevention and abatement of smoke, gas and fume nuisances, the examination and approval of plans of all heating and ventilation installations, and of all smoke, gas and fume creating prevention and abatement installations installed or reconstructed in any building, location or on any premises within the city of Chicago.

2124. Head of division — qualifications — duties.] The head of the division of air conditions control shall be an engineer qualified by technical training in the theory and practice of heating, ventilation and air conditioning. He shall also be experienced in and thoroughly familiar with the design, construction and operation of steam boilers and furnaces and in the theory and practice of smoke prevention and abatement.

Under the direction of the commissioner of health, he shall have charge of the division of air conditions control, shall supervise and direct its operations and shall be charged with the enforcement of all laws of the state and ordinances of the city relative to the preservation of the purity of the air. He shall conduct, or cause to be conducted, investigations and studies of the condition of the air of the city and the measures necessary to preserve the same in the highest possible degree of purity.

2125. Assistants and employes.] There shall also be employed in the division of air conditions control, such engineers, inspectors, assistant inspectors, deputy inspectors and other employes as shall be provided for by the city council.

2126. Construction and reconstruction of plants — plans and specifications — permit — Commissioner of buildings to supervise.] No new plants nor any reconstruction of any existing plant for producing power and heat, or either of them, nor any new chimney connected with a steam plant, shall be erected or maintained in the city until plans and specifications of the same have been filed in the office of and approved by the commissioner of health and a permit issued by him for such erection, reconstruction or maintenance. Plans and specifications to be filed with the commissioner of health shall show the amount of work and the amount of heating to be done by such plant and all appurtenances thereto, including all provisions made for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing smoke; said plans and specifications shall also contain a statement of the kind of fuel proposed to be used and shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building, wherein such steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely changed every ten minutes. Upon the approval of such plans and specifications a duplicate set of which shall be left on file in said office, and upon the payment of the fees as hereinafter provided, the commissioner of health shall issue a permit for the reconstruction, erection or maintenance of such plant. As soon as the commissioner of health has examined the plans and specifications submitted, and has issued a permit as above provided, he shall notify the commissioner of buildings to see that the execution of the work permitted is carried out in conformity with the plans and specifications, with special reference to the amount of space used, the size and construction of the chimney or chimneys used, the provision for the prevention of smoke, and the provisions for ventilation, and for the proper temperature in the engine and boiler rooms.

2127. Use of plant—certificate of commissioner of health required.] It shall be unlawful for any person to use any new or reconstructed plant for the production and generation of heat and power, or either of them, until he shall have first procured a certificate from the commissioner of health certifying that the plant is so constructed that it will do the work required, and that it can be so managed that no dense smoke shall be emitted from the chimney connected with the furnace or firebox.

2128. High-pressure boilers—repairs—permit required—penalty.] No owner shall alter or repair any brick work on or about a high-pressure boiler without first submitting plans and specifications to the commissioner of health and securing a permit therefor and such work shall be done only by one properly licensed therefor. Any person who shall violate this section shall be liable to a fine of twenty-five dollars for each day upon which he shall prosecute such alteration, change or installation without a permit, and

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2129. Emission of dense smoke—regulations—abatement—penalty.] The emission of dense smoke within the city from the smoke stack of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or from the smoke-stack or chimney of any building or premises, except for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire being built therein, is hereby declared to be a nuisance and may be summarily abated by the commissioner of health or by any one whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided. Any person, firm or corporation owning, operating or in charge or control of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or of any building or premises, who shall cause or permit the emission of dense smoke, within the city, from the smokestack or chimney of any such locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle, or other similar machine or contrivance, or from the smokestack or chimney of any building or premises so owned, controlled or in charge of him or it, except for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire being built therein, shall be deemed guilty of a violation of this section, and upon conviction thereof shall be find not less than ten dollars nor more than one hundred dollars for each offense; and each emission of dense smoke in violation of the provisions of this section shall constitute a separate offense for each and every day on which such violation shall continue.

TENEMENT AND LODGING HOUSES.

2134. Conform to requirements.] No house or building hereafter erected shall be used as a tenement house or lodging house, and no house or building heretofore erected and not now used for such purposes shall be converted into, used or leased for a tenement or lodging house, unless, in addition to the requirements hereinbefore contained in article IX of chapter XVII of this ordinance, it conforms to requirements affecting tenement or lodging houses, or both, as specified in the following sections of this article.

2135. Distances between buildings on same lot.] It shall not be lawful hereafter to erect for or convert to the purpose of a lodging house any building on any lot, other than a corner lot, where there is another building on the same lot, unless there is a clear, open space exclusively belonging thereto, and extending upward from the ground, of at least ten feet between such buildings, if they are one story high above the level of the ground; if they are two stories high, the distance between them shall not be less than fifteen feet; if they are three stories high, the distance between them shall not be less than twenty feet; and if they are more than three stories high, the distance between them shall be not less than twenty-five feet.

2136. Height of ceilings—windows.] In every such house hereafter erected or converted, every habitable room except rooms in the attic shall be in every part not less than eight feet in height from the floor to the ceiling; and every habitable room in the attic of any such building shall be at least eight feet in height from the floor to the ceiling throughout not less than one-half the area of such room. Every such room shall have at least one window connecting with the external air, or over the door an adequate ventilator connecting it with a room or hall which has a connection with the external air, and so arranged as to produce a cross current of air. The total area of window or windows in every room communicating with the external air shall be at least one-tenth of the superficial area of every such room; and the top of one at least of such windows shall not be less than seven feet and six inches above the floor, and the upper half at least shall be made so as to open the full width. Every habitable room of a less area than one hundred superficial feet, if it does not communicate directly with the air, and is without an open fireplace, shall be provided with a special means of ventilation by a separate air shaft extending to the roof, or otherwise, as the commissioner of health may prescribe.

2137. Lodging house—ventilation.] Every house, building, or portion thereof in the city, designed to be used, occupied, leased or rented, or which is used, occupied, leased or rented, for a lodging house, shall have in every room which is occupied as a sleeping room and which does not communicate directly with the external air a ventilating or transom window having an opening or area of three square feet over the door leading into and connected with the adjoining room, if such adjoining room communicates with the external air, and also a ventilating or transom window of the same opening or area communicating with the entry or hall of the house; or where this is from the relative situation of the rooms impracticable, such last mentioned ventilating or transom window shall communicate with an adjoining room that itself communicates with the entry or hall. Every such house or building shall have in the roof at the top of the hall an adequate and proper ventilator. No room in any lodging house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old and two hundred cubic feet for each such person of the age of twelve years or under.

2138. Water supply—cellar floor—ventilation of halls.] Every such house hereafter erected or converted shall have proper conveniences and receptacles for ashes and rubbish; it shall have water furnished at one or more places in such house or in the yard thereof, so that the same may be adequate and reasonably convenient for the use of the occupants thereof; it shall have the floor of the cellar properly cemented so as to be water-tight; the halls of each floor shall open directly to the external air, with suitable windows, and shall have no room or other obstruction at the end, unless sufficient light or ventilation is otherwise provided for said hall in a manner approved by the commissioner of buildings.

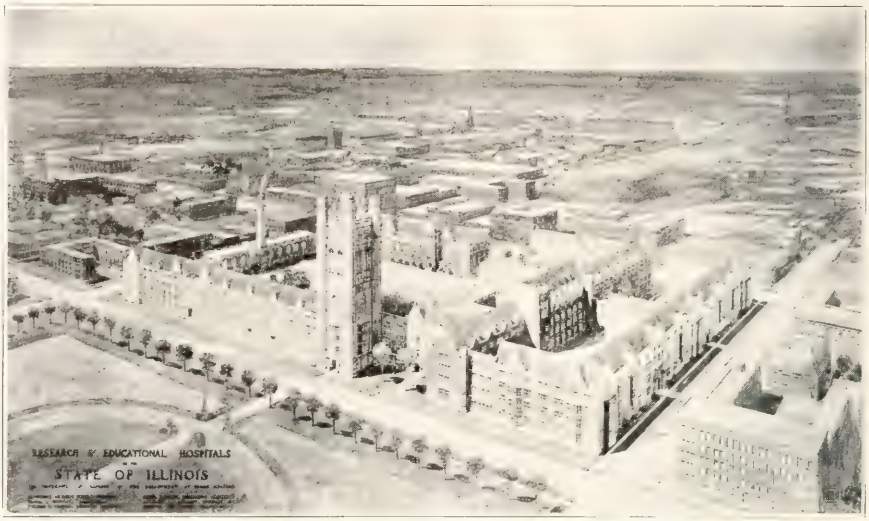
2146. Lodging house defined.] A lodging house shall be taken to mean and include any house or building or portion thereof in which persons are harbored or received or lodged for hire for a single night or for less than a week at one time, or any part of which is let for any person to sleep in for any term less than a week.

2147. Penalty.] Any person who shall violate, disobey, neglect, or refuse to comply with, or resist, any of the provisions of this article, or who refuses to comply with any of the sanitary regulations of the department of health concerning any of the matters or things mentioned in this article shall be fined not less than ten dollars nor more than two hundred dollars for each offense.

VENTILATION.

2152. Classes of buildings.] Whenever reference is made in this article to any class of buildings it shall be understood as meaning the kind of building designated in the same way in chapter XVII of this ordinance.

2153. Ventilation in buildings.] (a) The air in any room used as an auditorium in buildings of classes IVb, IVc, IVd and V hereafter erected, and the air in any room



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used as a class room or assembly hall in buildings of class VIII hereafter erected, shall be changed so as to provide each person for whom seating accommodation is provided in such auditorium, class room or assembly hall with at least fifteen hundred cubic feet of air per hour.

(b) In buildings of class VII hereafter erected, on floors frequented by the public, the air in such rooms shall be supplied at the following rates:

For each person in basement, two thousand cubic feet per hour.

For each person in first to third stories, both inclusive, fifteen hundred cubic feet per hour.

For each person in fourth story and above, except as hereinafter provided, thirteen hundred cubic feet per hour.

(c) For the purpose of determining the number of people on any floor in buildings of class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis.

Basement, per person, twenty square feet of floor area, exclusive of walls, stairs and elevators.

First story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Second story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Third story, per person, sixty square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above, per person, eighty square feet of floor area, exclusive of walls, stairs and elevators, except as hereinafter provided.

(d) Grocery departments and restaurants, per person, forty square feet of floor area, exclusive of walls, stairs and elevators.

(e) The amount of carbon dioxide in the air of any such auditorium, class room or assembly hall or space frequented by the public, in class VII buildings, shall not be permitted to rise above ten parts of carbon dioxide per ten thousand parts of air, measurements being taken at levels from two and one-half to eight feet above the floor, generally distributed, and the temperature in such spaces, when artificially heated, shall not exceed sixty-eight degrees Fahrenheit. Relative humidity shall not be less than forty-five degrees nor more than eighty degrees.

(f) The air in any room used as an auditorium in buildings of classes IV and V constructed prior to March 13, 1911, and the air in any room used as a class room or assembly hall in buildings of class VIII constructed prior to said date, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, class room or assembly hall with at least twelve hundred cubic feet of air per hour.

(g) The air in any rooms and floors in buildings of class VII erected prior to March 13, 1911, shall be supplied, by mechanical or other means, at the following rates:

For each person in basement, sixteen hundred cubic feet per hour.

For each person in first to third stories, both inclusive, twelve hundred cubic feet per hour.

For each person in fourth story and above, except as hereinafter provided, ten hundred and forty cubic feet per hour.

For each person in grocery departments and restaurants, twelve hundred cubic feet per hour.

(h) For the purpose of determining the number of people on any floor in buildings of class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, twenty square feet of floor area, exclusive of walls, stairs and elevators.

First story, per person, twenty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Second story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators, and inclosed show windows.

Third story, per person, sixty square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above, per person, eighty square feet of floor area exclusive of walls, stairs and elevators, except as hereinafter provided.

Grocery departments and restaurants, per person, forty square feet of floor area, exclusive of walls, stairs and elevators.

(i) The amount of carbon dioxide in the air of any such auditorium, class room or assembly hall or space frequented by the public in class VII buildings shall not be permitted to rise above twelve parts of carbon dioxide per ten thousand parts of air, measurements being taken at levels from two and one-half feet to eight feet above the floor, generally distributed; and the temperature in such places, when artificially heated, shall not exceed seventy degrees Fahrenheit. The relative humidity shall not be less than forty degrees nor more than eighty-five degrees.

(j) The word "auditorium," as used in this section in connection with buildings of classes IV and V, shall be construed as including the main floor, balcony and galleries.

(k) In buildings hereafter erected for, or converted to, the use of a factory, mill or workshop, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least fifteen hundred cubic feet of air per hour.

(l) In buildings used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least twelve hundred cubic feet of air per hour.

(m) In any building or room hereafter erected for, or converted to the use of, a factory, mill or workshop, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above ten parts of carbon dioxide per ten thousand parts of air.

(n) In buildings or rooms used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above twelve parts of carbon dioxide per ten thousand parts of air. The measurements in each case above enumerated in this paragraph shall be taken at levels from two and one-half feet to eight feet above the floor, distributed generally; and the temperature in such spaces, when artificially heated, shall not exceed sixty-eight degrees Fahrenheit, except as hereinafter provided; the relative humidity shall not be less than forty degrees nor more than eighty-five degrees.

(o) The above provisions and standards as to ventilation shall not apply to storage rooms or vaults or any place where the manufacturing processes therein conducted would be materially interfered with, or where manufacturing processes therein conducted would produce considerable quantities of free carbon dioxide, except that the air in such rooms or vaults or in any places of manufacture shall not be permitted to become detrimental to the health of those who enter or work therein.

(p) No part of the fresh air supplied in compliance with the requirements of this section shall be taken from any cellar or basement.

(q) No person, firm or corporation, either as owner, proprietor, lessee, manager or superintendent of any factory, mill, workshop or any other building where one or more persons are employed, shall cause, permit or allow the same or any portion apartment of any room in such factory

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or workshop, to be overcrowded or to have inadequate, faulty or insufficient light or ventilation.

(r) No person shall be exposed to any direct draft from any air inlet, nor to any draft having a temperature of less than sixty degrees.

(s) All poisonous or noxious fumes or gases arising from any process, and all dust of a character injurious to the health of persons employed, which is created in the course of a manufacturing process, within such factory, mill, workshop or laundry, shall be removed, as far as practicable, by either ventilating or exhaust devices.

2154. Charges for approval of plans for mechanical ventilation equipment.] The commissioner of health shall make the following charges for the approval of plans for mechanical ventilation equipment and for the inspection and testing of the same.

Five dollars for an equipment handling five thousand cubic feet of air per minute, or less, and one dollar for each additional capacity of one thousand cubic feet per minute.

The owner or contractor shall be granted a certificate of inspection when the final inspection and test is made and the fee paid.

No fee for minor alterations shall be charged unless the alterations include changes in the method of ventilating or in the total capacity of the equipment, in which case the charge will be one dollar for every one thousand cubic feet of air per minute additional capacity.

2155. Annual inspection fee.] An annual inspection of all mechanical ventilation equipment in public and semi-public buildings and places of employment shall be made by the commissioner of health to see that the same is in proper operating condition. The fee for the annual inspection shall be fifty cents per one thousand cubic feet or fraction thereof, of air handled per minute. Such annual inspection fee shall be paid in advance to the city collector on the first day of March of each year.

2156. Penalty.] Any person, firm or corporation violating or failing to comply with any of the provisions of this article shall be fined not less than five dollars nor more than two hundred dollars for each offense, and every day on which such violation shall continue shall be deemed a distinct and separate offense.

STORES, FACTORIES, WORKSHOPS—MISCELLANEOUS PROVISIONS.

2157. Ventilation of stores, factories, workshops, etc.] No person, firm or corporation, being the owner, proprietor, lessee, manager or superintendent of any store, factory, workshop or other structure or place of employment where workmen and workwomen are employed for wages, shall cause, permit or allow the same or any portion or apartment of, or any room in such store, factory, workshop or other structure or place of employment, to be overcrowded or inadequate, faulty or insufficient in respect of light, ventilation, heat and cleanliness; and in every such building or apartment, or room in any such building, where one or more persons are employed as aforesaid, at least five hundred cubic feet of air space shall be allowed to each and every person employed therein, and fresh air supplied by ventilation at the rate of four complete changes of air per hour during the hours of employment. No part of such air supply shall be taken from any cellar or basement.

2160. Seats for females.] It shall be the duty of all employers of females in any mercantile or manufacturing business or occupation to provide and maintain seats for the use of such female employes, and to permit, to a reasonable extent, the use of such seats by such employes during the hours of their employment, for the preservation of their health. Seats shall be furnished at the ratio of one seat for every four female employes. All mercantile and manufacturing occupations and establishments where females are employed shall be inspected by officers of the health department to ascertain if this section is complied with, and any employer violating any of the provisions of this section shall be subject to a fine of not less than five dollars nor more than one hundred dollars.

2161. Penalty.] Any person violating, disobeying, neglecting or refusing to comply with any of the provisions of this article, where no other penalty has been provided, shall be fined not less than ten nor more than one hundred dollars for each offense.

2175. Adequate water closets.] Every person who shall be the owner, lessee or keeper or manager of any tenement house, boarding house, lodging or manufactory, shall provide or cause to be provided for the accommodation thereof and for the use of the tenants, lodgers, boarders and workers therein, adequate privies, urinals and water closets, and the same shall be so ventilated, and shall at all times be kept in such cleanly and wholesome condition as not to be offensive to the persons within the building or to the public or be dangerous or detrimental to health.

2176. Roofs—drainage.] The roof of every house shall be kept in good repair and so as not to leak, and all rain water shall be so drained or conveyed therefrom as to prevent its dripping on the ground, or causing dampness in the walls, yard or area.

2177. Drainage from premises where no sewer exists.] Where no sewer exists in the street, the yard or area of all premises shall be so graded that all water from the roof or otherwise, and all filth, shall flow freely from such premises and all parts of same into the street gutter, by a passage beneath the sidewalk, but so arranged as to by a permanent cover, but so arranged as to permit access to remove obstructions or impurities. No such passage or drain or any appurtenance thereof, shall be permitted to become filthy or offensive, or to create a nuisance.

2178. Cisterns.] No cistern for the collection and storage of rain water from roofs shall be constructed or placed within any building that is used for human habitation or occupancy.

2179. Overflow from cistern.] No cistern used for the collection and storage of rain water from roofs shall have its overflow pipe directly connected with any sewer or drain.

If any overflow pipe is provided for any such cistern, such pipe shall lead to an area or gutter and shall have its outlet protected with a suitable metal screen.

2180. Water closets, etc.—prevention of sewer gas.] No water closet, sink, tub, vat or other structure shall hereafter be constructed within the city having connection with or by any sewer or underground passage, unless the same is provided with adequate or the best generally approved constructions and precautions for preventing gases and other offensive currents, substances and smells from passing up or out through such connection from such sewer or passage; nor shall any such water closet or privy be constructed without adequate provisions for the effectual and proper ventilation and cleansing thereof.

2181. Penalty.] Any person, firm or corporation that violates or fails or refuses to comply with any of the provisions of this article, or resists any officer in the discharge of his duty concerning any of the matteep in this article contained, where no o'the penalty is specifically provided, sha'e the fined not less than ten dollars and nospecial than two hundred dollars for eachnours of .i shall be make such

LAUNDRIES.

2375. Laundry defined.] Awith a reasoning, structure, room, establ:

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tion thereof, which is used for the purpose of washing, drying starching, or ironing shirts, dresses, underwear, collars, cuffs or other wearing apparel, table, bed or other household linens, towels curtains, draperies or other washable fabrics, such work being done for the general public, shall be deemed a laundry and subject to the provisions of this chapter.

The word "laundry," as used in this chapter, shall also be held to include any private laundry maintained or operated in connection with any hotel, restaurant or public institution, except a hospital or charitable institution where no charge is made for laundry services.

The provisions of this chapter shall not apply to any female engaged in doing custom laundry work at her home for a regular family trade, nor to any room, rooms or portion thereof, located in a tenement house or other dwelling, in which domestic laundry work is done by or for the occupants of such building exclusively.

2379. Penalty.] Any person, firm or corporation that shall hereafter establish, maintain, conduct, carry on or operate a laundry without first procuring a license so to do, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and each day or fraction of a day on which such person, firm or corporation shall maintain any laundry without a license shall be construed as a separate and distinct offense.

SANITARY REQUIREMENTS.

2380. Natural lights required — windows and skylights not to be obstructed.] No laundry shall be established, maintained, conducted or operated in any cellar, basement, or in any other room or place in any building which is not provided with sufficient natural light, by means of windows or skylights, so that on clear days, during the period between one hour after sunrise and two hours before sunset on sunshiny days, illuminometer tests shall show a minimum illumination of five foot candles in all parts of such room or place, not directly obstructed by machinery or other equipment. The general arrangement of all machinery and equipment in such laundry shall be such as not to unnecessarily obstruct the lighting and ventilating through such windows and skylights.

2381. Sleeping in laundries prohibited.] No person shall be permitted to sleep in any laundry, nor shall any sleeping room or living room be in direct communication with any laundry. No laundered or unlaundered fabric belonging to the trade of any laundry shall be stored or kept in any room which is used for living purposes.

2382. Sanitary conditions.] Every room or place used as a laundry, or for the storage of unlaundered or laundered fabrics in connection therewith, shall, at all times, be kept in good repair and maintained in a clean and sanitary condition as to floors, walls, ceilings, windows, woodwork, machinery, utensils and fixtures, and every such room or place shall be kept free from rats, mice and vermin, and all matters of an infectious or contagious nature.

No person who has tuberculosis, any acute or active venereal disease, any communicable or loathsome skin disease, or any other communicable disease, shall work in any laundry, and no owner, proprietor, manager or person in charge of any laundry shall knowingly require, permit or suffer any such person to be employed therein.

No wall paper shall be applied upon the walls or ceilings of any room used for laundry purposes.

2383. Clear height between ceiling and floor—ventilation—cubic feet of air space per person.] No laundry shall be established, maintained, conducted, or operated in any room or place in which the clear height between the ceiling and the finished floor is less than ten feet, or which is not ventilated by means of windows, skylight, air shafts, air ducts, or mechanical apparatus so that a complete change of air in all parts of such room or place may be made at least four times each hour; and in every such room or place at least one thousand cubic feet of air space shall be provided for each and every person employed therein; provided that any laundry now in existence may be maintained and operated at its present location in any room or place in which the clear height between the ceiling and the finished floor does not fall below eight feet, six inches.

Every room in any laundry (except the room or rooms used for drying purposes) in which the temperature and humidity are such as in the judgment of the commissioner of health might endanger the health of the persons employed therein shall be provided with a mechanical ventilating system approved by the commissioner of health.

2384. Floor—how constructed.] The floor of every laundry and every room or place in connection therewith, except the room or rooms in which wearing apparel, household linens, bedding, towels, or other fabrics are washed, shall be constructed of hardwood or any impervious material. The floor of the room or rooms in which wearing apparel, household linens, bedding, towels, or other fabrics are washed shall be constructed of hardwood with tight joints, concrete, cement, tile or stone laid in cement, or other impervious material, and shall be watertight and properly drained to the public sewer. The angles where the floor and wall join shall likewise be water-tight. Provided, that in laundries hereafter established, the floor of the wash room shall be of concrete, cement, tile, or stone laid in cement, or other impervious material, and shall be water-tight and properly drained to the public sewer.

2385. Plumbing and drainage facilities—plumbing fixtures.] Every laundry shall be provided with adequate sanitary plumbing and drainage facilities, and the installation of all drains and plumbing fixtures shall be in accordance with the requirements of the ordinance of the city at the time they are installed. Every water closet, sink, or other plumbing fixture, installed therein shall be of an approved type, impermeable and thoroughly sanitary.

2386. Water closet accommodations.] Every laundry shall be provided with separate water closet facilities for male and female employes, and every room or compartment in which any water closet is installed shall be provided with adequate natural ventilation by means of windows or skylights opening to the external air.

2387. Lavatory facilities—separate room or space for wraps or outer clothing of employes.] Every laundry shall be provided with sufficient and suitable lavatory facilities, including approved wash bowls, wash basins, or sinks, supplied with hot and cold running water, soap, clean individual towels, and such other equipment as the commissioner of health may deem necessary for the health and comfort of the persons employed therein.

A separate room, or sufficient space in a room, which is entirely separate from the room or rooms in which wearing apparel linen or other fabrics are washed or dried, and which can be maintained in a dry and sanitary condition, shall be provided and maintained in every laundry as a cloak or locker room in which employes may keep their wraps or outer clothing, and if the management of any laundry shall require the persons employed therein to wear any special or designated garment during the hours of employment, such space or room shall be so arranged that employes may make such changes as may be necessary with a reasonable degree of privacy.

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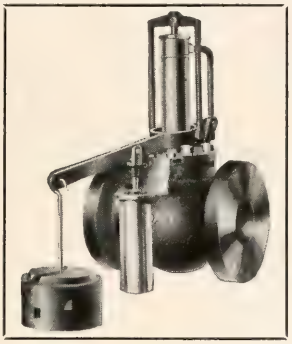

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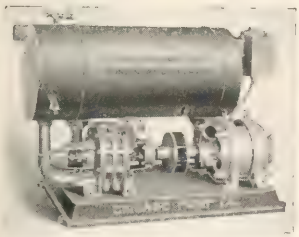

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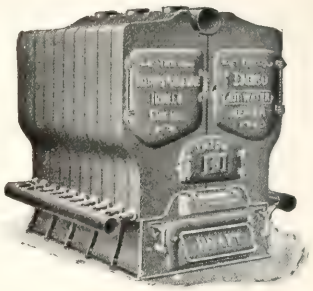

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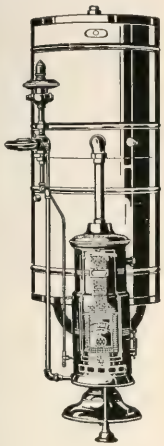

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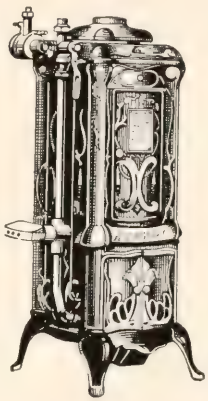

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SMOKE ORDINANCE

(Smoke Inspection Department, City of Chicago)

Be it ordained by the City Council of the City of Chicago:

Section 1. That Chapter LXVII of the Chicago Code of 1911, comprising therein sections 2337 to 2362, both inclusive, as amended, be and the same is hereby repealed and Article XXV-A (Chapter XXXVIII), in words and figures, as follows, substituted therefor:

1423-A. **Division of Air Conditions Control Established in the Department of Health—Duties.)** There is hereby established a division of the Department of Health of the City of Chicago to be known and designated as the division of air conditions control. All employees in said division shall be appointed according to law and shall be under the supervision and control of the Commissioner of Health.

The division of air conditions control shall be charged with the inspection and control of the installation and maintenance of heating and ventilating equipment, the inspection of rooms for natural and mechanical ventilation, the prevention and abatement of smoke, gas and fume nuisances, the examination and approval of plans of all heating and ventilating installations, and of all smoke, gas and fume creating prevention and abatement installations installed or reconstructed in any building, location or on any premises within the jurisdiction of the City of Chicago.

1423-B. **Head of Division—Qualifications—Duties.)** The head of the division of air conditions control shall be an engineer qualified by technical training in the theory and practice of heating, ventilation and air conditioning. He shall also be experienced in and thoroughly familiar with the design, construction and operation of steam boilers and furnaces and in theory and practice of smoke prevention and abatement.

Under the direction of the Commissioner of Health, he shall have charge of the division of air conditions control, shall supervise and direct its operations and be charged with the enforcement of all laws of the state and ordinances of the City relative to the preservation of the purity of the air. He shall conduct, or cause to be conducted, investigations and studies of the condition of the air of the City and the measures necessary to preserve the same in the highest possible degree of purity.

1423-C. **Assistants and Employes.)** There shall also be employed in the division of air conditions control, such engineers, inspectors, assistant inspectors, deputy inspectors, and other employes as shall be provided for by the City Council. The present officers and employes of the department of smoke inspection, which is hereby abolished, whose salaries may be appropriated for in the annual appropriation ordinance for the year 1919, shall be transferred to the Department of Health, and the civil service status of the officers and employes so transferred shall in no manner be impaired by such transfer.

1423-D. **Construction and Reconstruction of Plants—Plans and Specifications—Permit—Commissioner of Buildings to Supervise.)** No new plants nor reconstruction of any existing plants for producing power and heat, nor either of them, nor any new chimney connected with a steam plant, shall be erected or maintained in the City until plans and specifications of the same have been filed in the office of and approved by the Commissioner of Health and a permit issued by him for such erection, reconstruction or maintenance. Plans and specifications to be filed with the Commissioner of Health shall show the amount of work and the amount of heating to be done by such plant and all appurtenances thereto, including all provisions made for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing smoke; said plans and specifications shall also contain a statement of the kind of fuel proposed to be used and said plans and specifications shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, airshafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building, wherein such steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely changed every ten minutes. Upon the approval of such plans and specifications, a duplicate set of which shall be left on file in said office, and upon the payment of the fees as hereinafter provided, the Commissioner of Health shall issue a permit for the reconstruction, erection or maintenance of such plant. As soon as the Commissioner of Health has examined the plans and specifications submitted, and has issued a permit as above provided, he shall notify the Commissioner of Buildings to see that the execution of the work permitted is carried out in conformity with the plans and specifications, with special reference to the amount of space used, the size and construction of the chimney or chimneys used, the provision for the prevention of smoke, and the provisions for ventilation, and for the proper temperature in the engine and boiler rooms.

1423-E. **Use of Plant—Certificate of Commissioner of Health Required.)** It shall be unlawful for any person to use any new or reconstructed plant for the production and

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generation of heat and power, or either of them, until he shall have first procured a certificate from the Commissioner of Health certifying that the plant is so constructed that it will do the work required, and that it can be so managed that no dense smoke shall be emitted from the chimney connected with the furnace or firebox.

1423-F. **Chimneys and Furnaces—Repairs—Permit Required—Penalty.)** No owner shall alter or repair any brick work on or about a high pressure boiler without first submitting plans and specifications to the Commissioner of Health and securing a permit therefor, and such work shall be done only by one properly licensed therefor. Any person who shall violate this section shall be liable to a fine of $25.00 for each day upon which he shall prosecute such alteration, change or installation without a permit, and each day's violation shall constitute a separate offense.

1423-G. **Emission of Dense Smoke—Regulations—Abatement—Penalty.)** The emission of dense smoke within the city from the smoke stack of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or from the smoke stack or chimney of any building or premises, excepting for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire built therein, is hereby declared to be a nuisance and may be summarily abated by the Commissioner of Health or by any one whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided. Any person, firm or corporation owning, operating or in charge or control of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or of any building or premises, who shall cause or permit the emission of dense smoke, within the city, from the smoke stack or chimney of any such locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle, or other similar machine or contrivance, or from the smoke stack or chimney of any building, or premises so owned, controlled or in charge of him, her or them, except for a period of six minutes in any one hour during which the firebox is being cleaned out or a new fire being built therein, shall be deemed guilty of a violation of this section and upon conviction thereof shall be fined not less than ten dollars nor more than one hundred dollars for each offense; and each emission of dense smoke in violation of the provisions of this section shall constitute a separate offense for each and every day on which such violation shall continue.

Be it ordained by the City Council of the City of Chicago:

Section 1. That the Chicago Code of 1911 be and the same is hereby amended by repealing section 1423-H, as amended, and substituting therefor the following: (Amended June 23, 1920.)

1423 h. **Fees—when Remitted.)** The fees for the inspection of plans and issuing of permits, and for the inspection of furnaces or other fuel-burning apparatus or devices, and issuing of certificates, shall be as follows: Provided, however, that this section shall not apply to furnaces or other fuel-burning apparatus or devices installed or used to heat private residences, tenements or buildings consisting of three apartments or less:

For inspecting plans of new plants and of plants about to be reconstructed, two dollars.

For inspecting plans for repairs and alterations, one dollar.

For permits for the erection, installation, reconstruction or alteration of any furnace or other fuel-burning apparatus, smoke-prevention device or chimney, five dollars for each unit.

For examining or inspecting any new reconstructed furnace connected to a high pressure boiler after its erection or reconstruction and before its operation and maintenance, five dollars for the first unit or single apparatus, and three dollars for each additional unit or single apparatus.

For examining or inspecting any new or reconstructed furnace connected to a low pressure boiler or any other fuel-burning equipment, or any smoke-prevention device, after its erection or reconstruction and before its operation and maintenance, three dollars for each unit or single apparatus.

The aforesaid fees shall be paid to the City Collector prior to the approval of plans for such installations by the Commissioner of Health.

The fee for the examination or inspection shall include the issuing of a certificate for operation in case such certificate for operation is granted and shall be paid at the time the permit is secured.

The Commissioner of Health may and he is hereby directed and instructed to remit all inspection or examination fees charged against any and all charitable, religious and educational institutions, when the furnace or other device or apparatus inspected is located in or upon premises used and occupied exclusively by such charitable, religious or educational institution; provided that such charitable, religious or educational institution is not connected or carried on for private gain or profit; and provided further that the Commissioner of Health may require every application for the remission of such fees to be verified by the affidavit of one or more taxpayers of the City.

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

1423-I. **Violations—Prosecutions.)** Prosecutions for all violations of this chapter shall be instituted by the Commissioner of Health and shall be prosecuted in the name of the City of Chicago.

The issuance and delivery by the Commissioner of Health of any permit or certificate for the construction or reconstruction, or any permit for the alteration or repair of any plant or chimney, connected with a plant, shall not be held to exempt any person or corporation to whom any such permit has been issued or delivered, or who is in possession of any such permit, from prosecution on account of the emission or issuance of dense smoke caused or permitted by any such person or corporation.

1423-J. **Penalty.)** Any person who shall violate any of the provisions of this chapter (except as herein otherwise provided) shall be fined not less than twenty-five dollars nor more than one hundred dollars for each offense.

1423-k. **Fraud—Favors—Penalty.)** If any person acting on behalf of the city under the provisions of this chapter shall take or receive any money or any valuable thing for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if any inspector shall recommend the issuance of any certificate of inspection without having at the time stated, thoroughly examined and tested, the furnace, device or apparatus so certified, he shall be fined one hundred dollars for each offense.

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

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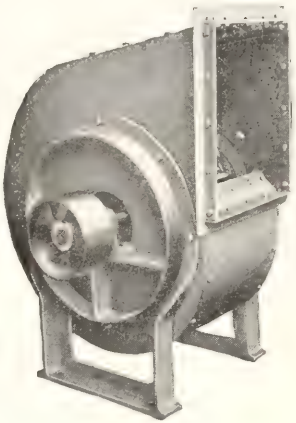

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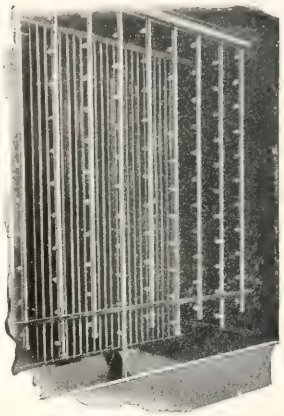

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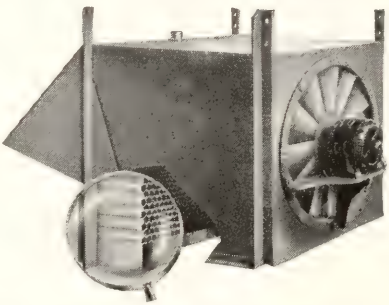

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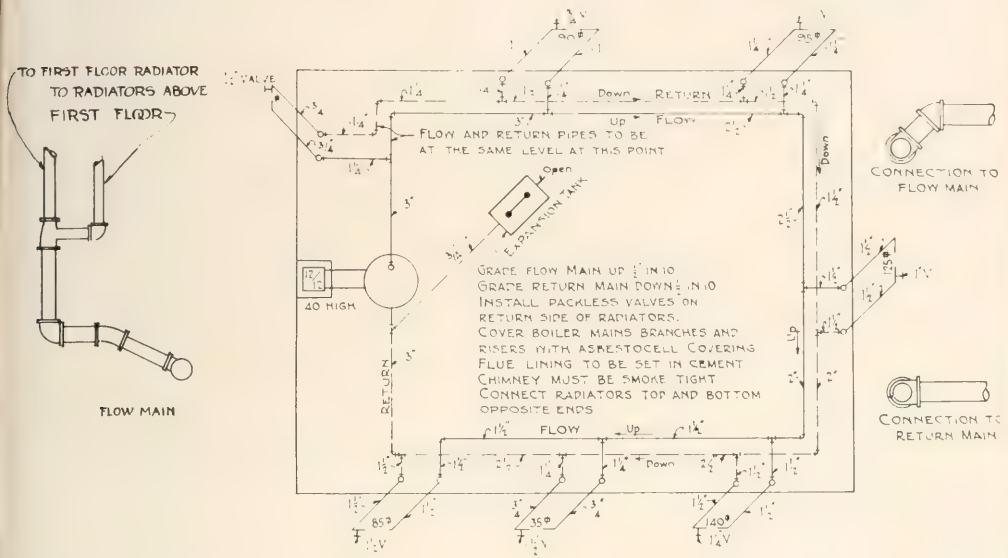
TWO-PIPE NON-SHORT CIRCUIT HOT WATER HEATING SYSTEM

HOMER R. LINN, Mechanical Engineer, Member American Society Heating and Ventilating Engineers



Gravity hot water heating systems may be divided into two general heads, viz.: Short circuit systems and non-short circuit systems. These may be subdivided into up feed, feed, down feed, etc.

In the short circuit system the flow and return mains run parallel, grade up away from the boiler and are of corresponding sizes where any radiator is taken off. The first radiator taken off of the flow main is also the first radiator on the return main. We, therefore, have the greatest push or pressure on the flow main and the greatest pull on the return main at this point. The result is that the tendency of all of the hot water is to go through this radiator, while the one on the farther end of the main has less pressure and therefore is sluggish. Various means are resorted to in overcoming this error, such as putting lead washers in the valve unions, taking flow connection off of the side of the main, etc. Any of these are uncertain and often cause trouble which is hard to locate.

In the non-short circuited system the flow main grades up away from the boiler. Where the connection to the first radiator is taken off of the flow main, the connection from the return of this radiator is brought into the end of the return main. In other words, this is the smallest diameter of the return main. It will be seen that we have here the greatest push on the flow main and the least pull on the return main. At this point both mains should be on the same level, but from here on the return main should grade down one-half inch in ten feet, while the flow main should continue to grade up one-half inch in ten feet. The last radiator taken off of the flow main will be the nearest radiator to the boiler on the return main: Therefore, at this point we have the least push in the flow main but the greatest pull in the return main. Thus it will be seen we have no short circuits, but a balanced condition throughout.

The accompanying sketch illustrates how the proper sizes of valves and pipes may be selected from the table. It also shows the best method of making connections to the flow main and also to the return main.

Unless boilers are furnished with integral metal insulating jackets, they should be well covered with a plastic covering having an air space between the boiler and the covering. All mains, branches and risers should be covered with a good grade of moulded covering. The expansion tank pipe may be taken off from either the flow or the return main, whichever is most convenient.

GRAVITY HOT WATER HEATING.

Sizes of mains for basement **two-pipe non-short circuit system** where mains are not over 100 feet long.

1¼"	pipe,	0 sq. ft.	to	100 sq. ft.
1½"	pipe,	101 sq. ft.	to	250 sq. ft.
2"	pipe,	251 sq. ft.	to	400 sq. ft.
2½"	pipe,	401 sq. ft.	to	650 sq. ft.
3"	pipe,	651 sq. ft.	to	1000 sq. ft.
3½"	pipe,	1001 sq. ft.	to	1900 sq. ft.
4"	pipe,	1901 sq. ft.	to	2500 sq. ft.
4½"	pipe,	2501 sq. ft.	to	3100 sq. ft.
5"	pipe,	3101 sq. ft.	to	4000 sq. ft.
6"	pipe,	4001 sq. ft.	to	5600 sq. ft.

Sizes of Risers.

¾"	pipe,	0 sq. ft.	to	70 sq. ft.
1"	pipe,	71 sq. ft.	to	120 sq. ft.
1¼"	pipe,	121 sq. ft.	to	180 sq. ft.
1½"	pipe,	181 sq. ft.	to	250 sq. ft.

Sizes of Valves.

½"	valve,	0 sq. ft.	to	60 sq. ft.
¾"	valve,	61 sq. ft.	to	90 sq. ft.
1"	valve,	91 sq. ft.	to	130 sq. ft.
1¼"	valve,	131 sq. ft.	to	180 sq. ft.
1½"	valve,	181 sq. ft.	to	250 sq. ft.

Grade Flow main **up** and Return main **down.**
½" in 10 ft.

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THE SERV-EL Automatic Refrigerator will promote health and increase the happiness in the home. It is a valuable addition to any home or apartment as to renting or selling. It is air cooled—no water connection. It keeps the food fresh and dry. It is safe—no ammonia. It is automatic—nothing to switch on or off. It is quickly installed—connects to any home lighting system. It is economical to operate. It is supreme—ideal for any place where there is electricity. We install and service the SERV-EL for a period of one year.

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ELECTRIC REFRIGERATION

S. W. THOMPSON, E. E.

Automatic, constant, positive **electric** refrigeration for use in the home or apartment is now a reality in a great many homes. The demand for this kind of home convenience has spurred manufacturers to make every effort to meet this demand by building a high grade machine that will measure up to all service demands. There are several makes of electric refrigerating units on the market, of which three are considered standard. There are special features embodied in the construction of each one of several standard types which should be considered before making a selection.

Electric Refrigeration, giving a constant dry cold is now available at a modest cost for every modern home and apartment. Without question, the same thought and care should be given to the subject of refrigeration for the home as has been given to the selection and installation of heating and plumbing equipment. Every modern home requires refrigeration service throughout the day and every day in the year. Automatic refrigerating equipment is now available which will provide this very necessary service at a low cost to install and operate.

The builder of every good home and tenant of attractive apartments will desire this convenience when they are familiar with the service secured through its use.

When specifying an **electric** refrigerator, it is very necessary to choose one that **will actually preserve food.** This is impossible for an ordinary ice-box to do. If a refrigerating unit is properly designed, it is possible to keep fruits and other foods fresh and tempting for **several weeks.** In other words, it is possible to have cold storage plant efficiency applied on a smaller scale to the needs of the home.

Knowing what proper **electric** refrigeration will do, there are several distinctive features which are desirable when choosing the best type of electric refrigerator. First of all, the best electric refrigerator must be absolutely **automatic in operation.** The control system should be simple, but positive in action, accurate, but free from delicate parts requiring expert attention or frequent adjustment.

In addition, the **electric** refrigerator should be constructed of high grade materials which will make it **strong** and **durable,** capable of withstanding years of service without replacements or expensive repairs. It must meet all service demands, able to deliver a constant, cold temperature to the interior of the food compartment. The box itself should be made of materials which will not warp and permit the warm air to reach the food compartment.

And last, but of extreme importance, is the kind of refrigerant used in the automatic electric refrigerator. A low pressure gas should be used as the refrigerant. Experience has shown that these low pressure gases as refrigerants now in use for home refrigeration are absolutely safe. One type may be more desirable than another on account of its efficiency and for other reasons, but as a general rule, the safety feature has been so thoroughly tested that complete assurance can be given on this point.

Electric refrigeration is fast taking the place of the old cake-of-ice method, because, in addition to the dollars and cents saving in ice purchases, there is a wonderful convenience, cleanliness and positive control of temperature and the correct preservation of all perishable foods.

To obtain the best results, the following points should be the prominent features in **electric** refrigerator specification:

Lower Temperature: Lower temperatures are secured by automatic electric refrigeration than possible with the old melting ice method. Very seldom is it possible to secure temperatures below 50 degrees in the food compartments of an ordinary ice-box where melting ice is used. In a mechanically operated box the temperature can be held at approximately ten degrees colder. With the ice melting method, the box is cold, as the ice bunker is filled, but as the ice melts away, the temperature rises until the danger point has been reached.

Constant Dry Temperature: Through the use of automatic control, a constant dry temperature is secured in the refrigerator. This is of great importance, as foods will be properly preserved under such conditions. This constant dry cold is secured without any thought or attention on the part of the user.

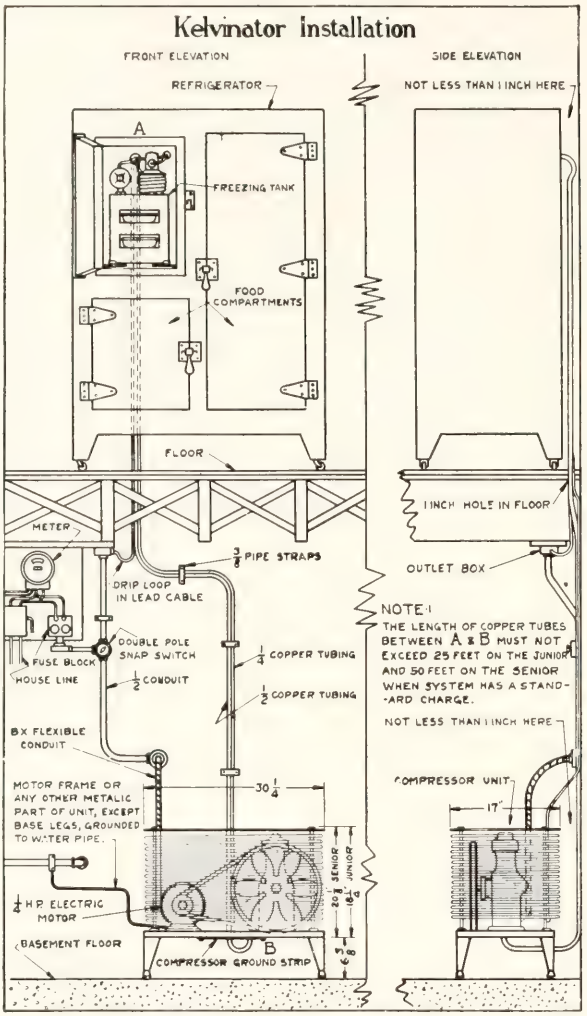
Cleanliness: The interior of an electric refrigerator is perfectly clean, as there is no melting ice or moist air to collect dirt and cause mold to accumulate. An electric refrigerating unit is easy to keep clean, as there is no accumulation of slime in a drain evident with the ordinary ice-box.

No Ice Worries: With an automatic electric refrigerating unit, there is no reason to worry about ice shortage, neither must you bother about ice cards or whether ice delivery will be made when needed.

Economy of Operation: It costs less to operate a good electric refrigerator than would be the expense of buying ice for the same size refrigerator; besides the ice method is not constant refrigeration, and the food loss is material over a period of time. Electricity used is paid for once a month while ice must be paid for daily or on delivery.

Reliable Temperature Control: Practically uniform temperature can be maintained either by means of pressure switch operating between definite pressure limits or by the thermostat regulation similar in operation to those so universally used on heating equipment.

Compact Construction: There are electric refrigerating units constructed on one base that can be installed in a basement or be-



Easy to Install

The drawing at the left shows the details of a typical Kelvinator Installation. The condensing unit, shown in the basement, can be installed in any out-of-way place.

Fits Any Refrigerator

The Kelvinator freezing unit fits into the ice compartment of any good refrigerator. It keeps the air in the refrigerator frosty and dry and always at the same, low, unvarying temperature.

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Kelvinator, the oldest domestic electric refrigeration, points to innumerable installations made years ago which are still operating as efficiently as ever.

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Kelvinator

ELECTRIC REFRIGERATION

neath the refrigerator itself. The latter type is particularly compact, as the whole refrigerating equipment is then mounted on castors and can be readily moved from place to place. Different size units of this type are manufactured. Attractive appearance is a feature that appeals to anyone with taste for proper equipment and furnishing in the home.

No Plumbing Connections: This feature is particularly desirable where the refrigerating unit is owned by lessees of apartments, as the refrigerator can be readily moved from one place to another with a minimum amount of work and expense.

Ice for Table Use: The electric refrigerator provides plenty of ice for table use. The amount that can be frozen in twenty-four hours varies with the size of the unit from ten to twenty-five pounds of ice. The ice is frozen in small cubes just the proper size to insert in a water glass for table use.

The foregoing features are desirable points in the selection and specification of electric refrigerating units in the home and apartment. Many units are now in use and giving satisfaction, and the future of this type of cooling is unlimited.

In the Chicago district there are upwards of five thousand electric refrigerating units in daily operation in homes. The comfort and convenience these machines afford their owners is reflected in the satisfaction expressed with the electric refrigerator. The modern home is assured all the cooling comforts and delicacies that are in much demand during the hot summer months. Delicious sherbets, frappes, custards and mousses are easily prepared and other foods are much more appetizing through its use. All this can be had for a yearly current consumption of between 500 and 600 kilowatt-hours, or at an expenditure of less than the average home pays for ice.

The Kilowatt-Hour Current consumption as shown in the accompanying table is representative of various tests made on different makes of refrigerating units. The three prominent makes each use a one-quarter horsepower motor and the operating characteristics are quite similar. The table refers to an installation in an eight-room residence. Room temperature, service demands, operation of the refrigerating box itself, may make a slight change in these figures.

The rates used in figuring the cost of the current consumption are the rates for service prevalent in Chicago, namely:

1 9c for first 30 hours' use of maximum demand.
2 6c for second 30 hours' use of maximum demand.
3 3c for all over 60 hours' use of maximum demand.

The first and second rates are subject to a prompt payment discount of one cent per kilowatt-hour, and the figures shown in the table are net.

The ice consumption is based on an assumption of all year use. This yearly use is quite representative of present home demands in large cities. In figuring the cost of ice, the rate of 60c per hundred pounds is used, based on the following monthly consumption:

Oct., Nov., Dec., Jan.,
Feb., Mar., Apr...400- 600 lbs. per month
May and Sept.....500- 700 lbs. per month
June, July and Aug..750-1,000 lbs. per month

A record not being available of the cost of ice consumption in the home from which the current consumption was obtained, it was not possible to get an actual comparison. In figuring the ice cost, the consumption is based on figures supplied by various home owners whose opinion and experience is believed to be representative of actual conditions.

Table Showing Comparative Ice and Current Costs.

Month	K. W. H.	Approx. Current Cost	Approx. Ice Cost
January	50	$ 1.92	$ 3.00
February	40	1.62	3.00
March	44	1.74	3.00
April	50	1.92	3.00
May	49	1.89	3.50
June	72	2.58	5.00
July	77	2.73	5.00
August	69	2.49	5.00
September	67	2.41	3.50
October	60	2.22	3.00
November	51	1.95	3.00
December	51	1.95	3.00
Total	680	$25.42	$43.00

NOTE—The figures quoted above regarding costs are exclusive of the cost of the installation which may be figured according to the size and type selected.

The cost per unit being between $275.00 and $650.00, depending upon the size and whether or not the ice box is included.

Refrigerating Equipment for Commercial Use

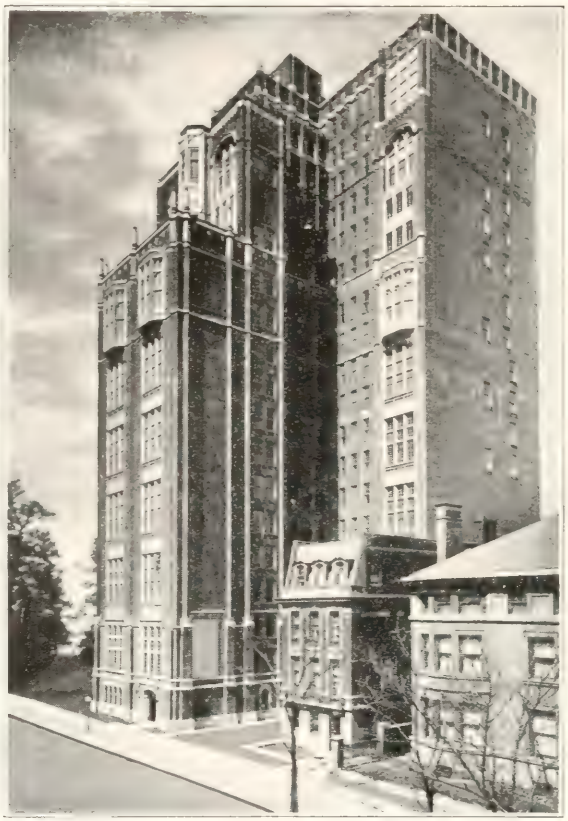
The popularity of the household type electric refrigerator has created a demand for a larger type machine which is capable of supplying the refrigeration requirements of a country club, large country homes, grocery store, delicatessen, meat market, florist, restaurant and small hotels. This type of machine must be more ruggedly constructed to meet the additional service demands and provide sufficient cooling capacity to maintain a temperature low enough to properly preserve food. This is especially desirable where room temperature is quite often above normal and where the use of the refrigerator causes considerable loss of cold.

Electric refrigerator manufacturers have placed on the market a ¼ ton capacity direct connected machine, which is operated by a ¾ H. P. motor and weighs about 575 pounds net. This machine is designed to provide refrigeration equivalent to the melting of 750 pounds of ice in 24 hr. operation. The unit should therefore be limited to refrigerators where the average ice-melting in twenty-four hours is not to exceed 375 pounds or about 2500 per week, nor a maximum of 600 pounds in a twenty-four hour day during the warmest weather. If applied to these conditions the average operation would represent about 12 hours a day with a maximum of 20 hours operation at peak periods.

This type of machine is water cooled and required about thirty gallons of water per hour under normal working conditions. The water supply to the condenser is governed by a pressure regulating valve which is operated by the pressure in the condenser so that the amount of water flowing through the condenser is automatically controlled so as to produce a uniform condensing pressure and to automatically start the flow of water at the beginning of the operation of the machine. An automatic cut-out is provided to stop the operation of the machine in case the water supply fails, this cut-out being operated by pressure from the condenser.

Ice-cream Cabinet

Electric refrigerating machines are now applied to cooling ice-cream cabinets of either six or eight-hole capacity. The advantage of this clean, automatic method of refrigeration is very obvious over the old methods of packing and repacking with ice. This method saves time and is more convenient and sanitary. The smaller type refrigerating unit has ample capacity for the six or eight-hole ice-cream cabinet. One of the big advantages of this method of cooling is the saving made due to the reduction in shrinkage, of about 2 quarts to every five gallons of ice-cream. Automatic, constant, refrigeration prevents this loss.



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[illegible] Kenyon, Lee, Architects — G. Ernest Wiltfey, Plumber

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Since 1855 Wolff Plumbing Fixtures have been used in the better grade of construction. In fairness to your clients your first consideration should be

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Quality Plumbing Since 1855

MODERN SANITATION OF BUILDINGS

By LEO H. PLEINS, Architect and Sanitary Engineer

The primary object of this article is to present to Architects in as brief a form as possible, data, which the writer trusts may be of service in their office practice in the preparation of plans and specifications covering plumbing work.

The great importance of sanitary plumbing work is daily becoming more and more recognized and hence if the Architect is to give his client full service, plumbing must be given the same careful consideration as the other structural parts of the building.

For convenience of reference the article is arranged under four headings—"Drainage of Building";—"The Water Supply";—"Arrangement of Toilet and Bath Rooms"; and "Plumbing Fixtures". Space does not permit of covering all that may be said under each heading, but endeavor has been made to mention characteristic features of importance, that should be given consideration in the proper analysis of each particular problem.

DRAINAGE OF BUILDINGS.

I. **Proper Fall to Main Sewer.** When a survey is made the location and size of main sewer should be indicated thereon. If stubs to curb are in place their location, size and grade should be shown. The basement floor grade should always be given and also grade of main sewer at curb or street. The desirable grade for house sewer connections is ¼" to one foot. If this cannot be obtained, the grade may be reduced but in this case the size of the tile pipe must be increased according to the length of the connection from building to main sewer.

See Table I for carrying capacity of tile pipe at varying grades. Discharge is given in cubic feet per second. Convert this into gallons by multiplying by 7.50

II. **When Main Sewer is Above Level of Basement Floor Grade:** In this case all drainage from floor drains or fixtures in basement must be run to a sump basin and elevated by means of a pump. If no water closets or urinals are to be installed in basement the pump will be described as a **bilge** pump. If water closets and urinals are to be provided in basement, the pump will be described as a **sewage ejector.**

Obviously all waste and soil lines that may be drained by gravity, such as all drainage from floors above the basement shall be run into a horizontal line and this carried under ceiling of basement and thence through the wall connecting to the main sewer at such distance below grade as necessary to properly drain the system. The discharge from Bilge Pump or Sewage Ejector shall be connected into the horizontal line under ceiling of basement at such point inside of building as may be convenient.

If a Bilge Pump is installed—the basin for a single pump should be as follows: For pump from 10 to 30 gallons per minute, basin to be 30" diameter; for a pump from 50 to 100 gallons per minute, basin to be 36" diameter and for a pump from 125 to 200 gallons per minute, basin to be 42" diameter. For two or duplex pumps—basin to be 48" diameter for pumps from 100 to 125 gallons per minute and 60" in diameter for pumps of 150 to 200 gallons per minute capacity. All basins should be 36" deeper than lowest inlet entering the same.

If a Sewage Ejector is installed, the basin for a single ejector shall be as follows: For an ejector from 50 to 75 gallons per minute —basin to be 36" in diameter; for an ejector of from 100 to 200 gallons per minute, the basin should be 42" diameter and for an ejector of 250 to 350 gallons per minute, the basin should be 48" in diameter. For two or duplex ejectors, the basin to be 48" in diameter for ejectors of from 50 to 100 gallons per minute and 60" in diameter for ejectors of from 125 to 350 gallons per minute. All basins should be 48" deeper than the lowest inlet entering the same.

The best motive power for Bilge pumps or Sewage ejectors is a direct connected vertical type electric motor—the operation of which is automatically controlled by means of a float switch.

Wherever possible, both Bilge pumps and Sewage ejectors should be installed in duplicate sets. With duplex pumps the automatic control is arranged so that the same will start one pump when the water level has raised, holding the second pump in reserve, and starting the second pump when the first is not capable of handling all the water. Both pumps will then operate until normal condition has been restored. The automatic control should be provided with a four-pole transfer switch so connected up that by throwing over switch, each pump will operate at alternate periods, holding the other as reserve and in this way, equalize the wear on the pumps.

Always ascertain and specify the correct electric current and provide for service wires to within 5 feet of pump to be furnished by contractor for Electrical Work. If current is Direct give the voltage and if current is Alternating give voltage cycles and phase.

The motors for pumps are usually mounted on a cast iron or steel cover which forms a support for motors, contact apparatus etc. The basins may be of cast iron, steel, brick or concrete. If of the latter materials basins must be thoroughly waterproofed.

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A swinging check valve, cast iron body, brass mounted must be placed in the horizontal discharge pipe between pump and sewer.

Blow-off drainage from boilers cannot be run directly into bilge pump or sewage ejector basins—but must always discharge into a cast iron or steel blow-off basin or muffler tank. From this basin the drainage may then be run to bilge or sewage ejector basins, if it is impossible to drain the same by gravity.

Diameter.	Slope, or Head Divided by Length of Pipe.							
	1 in 40	1 in 70	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
5 in.	.456	.344	.288	.204	.166	.144	.137	.118
6 in.	.762	.576	.482	.341	.278	.241	.230	.197
8 in.	1.70	1.29	1.08	.765	.624	.54	.516	.441
9 in.	2.37	1.79	1.50	1.06	.868	.75	.717	.613
Slope	1 in 60	1 in 80	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
10 in.	2.59	2.24	2.01	1.42	1.16	1.00	.90	.82
12 in.	4.32	3.74	3.35	2.37	1.93	1.67	1.5	1.37
Slope	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600	1 in 700	1 in 800
15 in.	6.18	4.37	3.57	3.09	2.77	2.52	2.34	2.19

Table I.

Boiler Blow-Off Basins:

These are usually included under the heading of "Heating Work." The contractor for this work makes all connections between same, boiler blow-offs, drips, etc. When directly connected to the house sewage line the plumbing contractor makes such connection as also the venting of blow-off basins through roof. Attention in this connection is called to the requirements of the Chicago Ordinance prohibiting the discharge from basins being made into tile sewers within any building, furthermore, that the water discharged into a sewer shall not exceed 120° "F." It is necessary therefore to use cast iron pipe and in order to prevent leaks of joints, therefor cast iron hub and spigot pipe should be made with iron cement instead of lead—or flanged pipe used with asbestos graphite gaskets.

The following Table (II) may be of service to determine the proper size of basin to be provided:

Table II.

For Boiler of 25 to 75 H. P. use Basin 36" diameter by 42" deep.
For Boiler of 100 to 200 H. P. use Basin 42" diameter by 60" deep.
For Boiler of 250 to 400 H. P. use Basin 60" diameter by 72" deep.

For more than 400 H. P. use two or more basins—using the above as multiples according to horse power of boiler.

A ¾" or 1" cold water supply with control valve should be made to each blow-off basin and such connection will be found of service in cooling excessively hot blowoff water and help to condense steam vapors.

Downspouts and Downspout Drains:

In many localities the drainage from downspouts must be connected into a "Storm Water Sewer"—and not to the "Sanitary or house sewer." In either case arrangement of downspouts and drainage from same may be the same.

The best material to use for vertical inside downspouts is extra heavy cast iron pipe and fittings of proper size. All outside sheet metal downspouts should be connected into cast iron pipe and fittings above grade and cast iron pipe be run to proper depth below grade and connected to tile pipe by means of a cast iron quarter-bend.

Before making connection to roof—downspouts should be increased one size and the roof connection should be made to allow for expansion and contraction by means of a copper or lead sleeve. Roof fittings and strainers should be of cast iron and well flashed with copper or lead.

"Josam" or "Holt" roof strainers of proper size and type make the best roof strainer connections.

To determine the proper size for downspouts the following may be of service.

A rainfall of 1-inch in depth on an area of 100 square feet will give a run off of 62 gallons.

Downspouts proportioned as follows have been found in practice to give satisfactory results. For small roofs, 1 sq. inch in sectional area of the leader for each 150 sq. ft of roof surface. For medium sized roofs 1 sq. in. in sectional area of the leader for each 200 sq. ft. of roof surface. For large roofs, 1 sq. inch in sectional area of the leader for each 250 sq. ft, of roof surface.

Judgment must be used in arranging downspouts so as to equalize the square feet of drainage as nearly as possible.

Outside downspouts should be avoided, especially in cold climates, as they are constantly giving trouble on account of freezing and therefore cause damage to roofs and walls.

Where roofs are covered with gravel or in localities where high winds are likely to cover roof with debris, etc., the downspouts should be provided with cast iron gravel basins or running traps with cleanouts. Gravel basins or traps must always be used when connecting downspout drains to sanitary sewers, where ordinances do not require such downspout drains to be run into outside catch basin as required by the Chicago ordinance.

Size of Main House Drain:

The size of the main house drain when serving as a combination drain (sanitary and rain water) may for all practical purposes be determined by the total surface area covered by the building or buildings and paved surfaces to be drained, by the following table, which is based on cast iron pipe. If vitrified tile sewer pipe is used the diameter of pipe as given must be increased one size for same area of drainage.

Square Feet of Drainage Area.

Diameter	Fall ⅛ in. per foot	Fall ¼ in. per foot	Fall ½ in. per foot
4 inch	1.500	1.800	2.500
6 "	3.000	5.000	7.500
8 "	6.000	9.100	13.600
10 "	9.000	14.000	20.000

Back Water Valves:

Whenever the grade or size of sewer in street is such that there is a possibility of the same backing up—the house sewer must be provided with a cast iron back water valve of approved type and this valve should be placed in a manhole or otherwise located

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so as to be accessible for inspection or repair. It is desirable to use a back water valve having a flushing connection so that the line may be flushed.

Where water closets or urinals are located in basements and connected to horizontal house sewers which are likely to back up during heavy rains it is advisable to place a double gate valve on the branch to such fixture in addition to the back water valve on the main drain so as to prevent sewage from backing up through these fixtures in event of the back water valve not operating properly

Flush Tanks:

Whenever the sewer in street to which connection must be made forms what is known as a "dead end" it is desirable to provide a flush tank which when filled to a proper height with clean water, will automatically discharge the contents into the sewer and thereby keep the sewer free and prevent obstructions that might otherwise occur. These flush tanks may be of two types—as illustrated herewith. Type A being suitable for flushing more than one dead end; Type B may be used if the "dead end" will be continued at some later time—in which case the flush tank may be converted into a standard manhole by taking off the cap at end of siphon and removing the latter.

Soil Pipe System:

Cast iron extra heavy soil pipe and fittings are the most permanent and best for soil, waste and vent systems and should be used wherever possible. While the ordinances of some cities require the use of wrought iron pipe where buildings are over seven stories in height, there is no reason why this exception should be made, as extra heavy cast iron soil pipe and fittings have been used in buildings 16-stories in height and the joints double calked as described on page 457. (?)

The very best and most durable material for soil, waste and vent systems is full iron pipe size annealed brass pipe with red metal cast brass fittings. However, the cost of such an installation is usually greater than most owners care to invest.

Considering such ordinances as require the use of wrought iron pipe for soil, waste and vent systems, we would say, that unfortunately these ordinances are not specific in stating that when wrought iron pipe is used —it shall be Genuine Wrought Iron, hence most installations are made with commercial steel pipe, which in the opinion of the writer should never be used. In many cases where the question of cost of genuine wrought as compared to steel has been an issue—Architects and Engineers have expressed the opinion that genuine wrought pipe was not worth the difference in cost. This opinion is not shared by the writer but as stated above, I believe, that extra heavy cast iron soil pipe is the most logical material to use when all facts are taken into consideration.

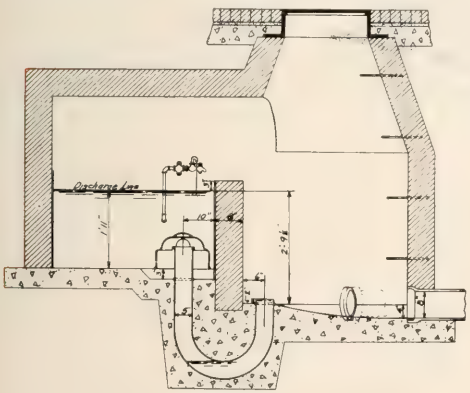
In the opinion of the writer there is a great opportunity for manufacturers of cast iron pipe to perfect a system that may be installed using cast iron threaded pipe with cast iron threaded fittings. This should make absolutely the best piping system for every class of work. The threaded pipe and castings would naturally be easier to install than cast iron soil pipe and fittings with double calked joints.

If Genuine Wrought iron pipe is used for soil, waste and vent piping—all vent extensions up thru roof should be terminated with extra heavy cast iron soil pipe—the length of which should not be less than 10 feet, and more, if possible.

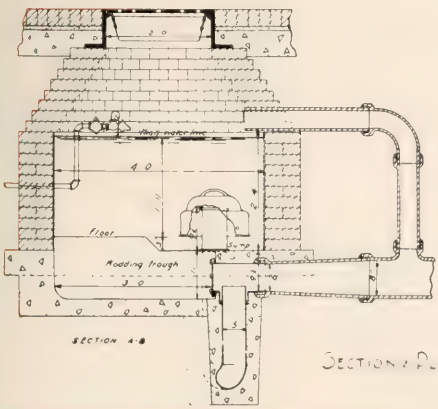
Simplicity in arrangement of soil, waste and vent stacks is desirable and it is extremely desirable to make diagrams of the system that will be of aid to the plumbing contractor as well as of being of service to the other contractors on the work. In order to be of service these diagrams must be accurately drawn and amplified by details where necessary.

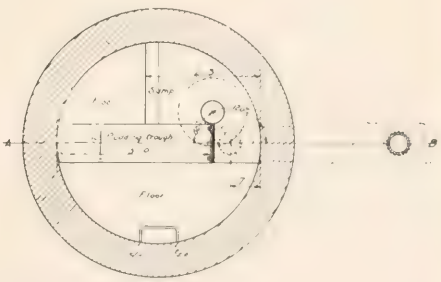
The importance of a plumbing plan carefully laid out has unfortunately not been properly recognized. At the present time the cost of material is such that the Architect who is going to give his client the service for which he is paid—must more than ever consider every item that will form a part of the work.

The structural parts of a building are carefully analyzed, weights of steel columns, girders, etc., proportioned to the loads they must carry, and all this work carefully de-



SECTION OF FLUSH TANK TYPE "A".





SECTION & PLAN OF FLUSH TANK TYPE "B"

IS there any finer bathtub for a fine bathroom than the Kohler "Viceroy" bath—from the architect's standpoint or the plumber's, the bather's or the housekeeper's?

We do not think so. No matter whether the bathroom is to be simple or elaborate, it is difficult to imagine anything more completely satisfactory in practicality, sanitary fitness, and simple beauty, than a "Viceroy" bath with its graceful lines and its rich and lustrous covering of pure white enamel.

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tailed—and still the plumbing work is very rarely even laid out beyond a mere indication of the main run of soil or sewer lines—on the basement or foundation plan.

Specifications very often contain a clause requiring the successful bidder to submit a piping plan for the Architect's approval before commencing work. They might just as properly contain clauses asking the successful bidders to submit details for the elevations of the buildings, etc., etc. It is the Architect's duty to secure the best proposition possible for his client and therefore the plumbing work should be drawn—detailed and specified in such a manner that all bidders on the work may estimate on the same fixed basis and not permit them to submit figures based upon their ideas and conception of what may be required for the work. Such methods are very unsatisfactory and can only result in misunderstanding and most frequently in absolute failure at the expense of the client.

Whenever wrought iron pipe and cast iron drainage fittings are used, either asphalted in and out or galvanized—the stacks should be placed in pipe shafts so that the piping may be inspected and sections replaced when necessary without disturbing walls and partitions. All vents through roof should be of extra heavy cast iron soil pipe for a distance of not less than 10 feet below. Never place wrought iron pipe under basement floors. All such drainage pipe must be of extra heavy cast iron soil pipe and fittings.

When the building covers considerable area—it is desirable to use cast iron or waterproof concrete catch basins on the main lines and at intersections so as to permit of rodding the lines. In place of catch basins—large cleanouts may be used—which must always be the same size of pipe up to 6". Such cleanouts should be placed in manholes with cast iron covers large enough so that the lines can be rodded properly. Cleanouts must be placed at the foot of all stacks and wherever a change in direction of a horizontal line occurs. Cleanouts for best work should be of the heavy brass bell ferrule type with brass trap screw. With ferrules of iron the brass trap screw rusts in so that it is difficult to remove the same.

Changes in direction of horizontal lines should always be made on as full a sweep as possible, using Y-branches and 45° bends.

Connection between vertical stacks and horizontal drains in basement must always be made by means of Y-branches and 45° bends. Connection between horizontal lines on upper floors may be made by means of sanitary tees—although Y-branches are better.

All horizontal soil and waste lines should have a fall of ¼" to the foot toward outlets where possible.

All horizontal vent lines must be pitched so that water of condensation will drain freely into soil and waste lines or stacks, and foot of all vent stacks must be connected into a main soil or waste line or stack.

Reventing of each plumbing fixture is generally required. The Chicago ordinance prescribes this; other localities permit circuit venting and hence, the Architect must necessarily familiarize himself with the requirements of ordinances that may be in force in the locality in which his building is to be erected.

All main vent stacks must be extended up through roof. On pitched roofs, the vents may extend above roof 6 to 12 inches, on flat roofs 18 inches to 2 feet will be better in order to be safe in case of heavy fall of snow and to avoid dirt entering same.

In the Eastern, Central and North Western States it is necessary to increase all vent stacks at least one size up to 6 inch before passing through roof. The minimum size vent through roof should be 4 inch. All extensions through roof must be cast iron. Increasing stacks makes it possible to turn down lead or copper flashing into the pipe and leaves the extension free to provide for expansion and contraction. While caps or vent cowls should never be placed on top of vent stacks, it is desirable to use a strainer of cast iron of a removable type. Galvanized wire strainers are worthless. See Drawing.

Lead wastes are infrequently used in modern practice so we will only briefly mention them. When lead waste piping is used—it should be of a weight known as "medium" and when connected to wrought iron piping the connection must be made by means of extra heavy brass soldering nipples and a good heavy wiped joint. When connected to cast iron pipe—extra heavy brass bell ferrules must be used, wiped to the lead pipe and calked into the cast iron pipe.

JOINTING OF PIPE must be carefully done. For cast iron soil pipe—the following is a good method.

All joints of cast iron soil pipe shall be made with oakum and pure pig lead, bedded with hammer and calking iron. A gasket of well packed oakum shall be placed at the bottom of the hub extending above the rim of the spigot to prevent the escape of lead. The hub to be filled at one pouring and the lead calked with such force as to make the joint absolutely water tight under a pressure of at least 10 lbs. per square inch. All joints shall be filled at one pouring; if it fails to run full, it shall be dug out and repoured. Lead shall not be covered with paint, putty or otherwise.

Twelve ounces of lead should be allowed for each inch of diameter of pipe or fitting on which joint is made.

For buildings over six stories in height the cast iron soil pipe joints shall be double calked in the following manner: The oakum shall be well braided and before being placed in position shall be oiled and then well calked; then fill in the hub to within ¾" of the top with molten soft pure lead and thoroughly calk. After the lead has been uniformly calked, fill in with molten lead to the top of hub and thoroughly calk—so as to make an absolutely perfect joint. All joints showing leaks under testing shall be dug out, repoured and double calked as above.

With cast iron pipe double calked as above, installations have been made in buildings 16 stories in height in which the entire system is still in excellent condition after a period of 27 years.

Joints between lead and cast iron pipe to be made by means of brass ferrules wiped to the lead pipe and calked into hub of cast iron fittings. Joints between lead and wrought iron pipe to be made by means of soldering nipples with hexagon nuts. Joints between wrought iron pipe and fittings to be screwed home into couplings or fittings without the use of any red lead or other compound.

No steam or cast bushed fittings to be used on any drainage or vent work.

Joints of tile pipe shall be made with neat Portland cement. A cleaner to be run through every length of pipe as it is laid so that no mortar used in jointing will adhere to the interior of the pipe. The connection between cast iron and tile pipe shall be made with a collar of concrete 6 inches thick and extending not less than 8 inches on each side of joint. See illustration.

All soil, waste and vent piping shall be tested. Ordinances usually prescribe the manner of testing which may be by means of water, air, peppermint or smoke on new work.

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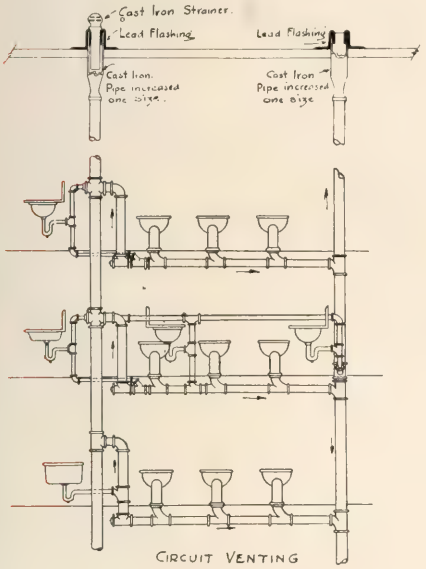
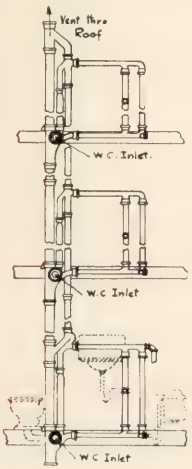
The following illustrations show several methods for reventing plumbing fixtures in accordance with the Chicago practice and also by what is known as the "Circuit Venting" system.

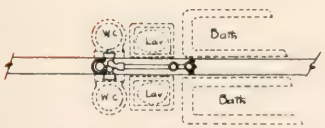


CIRCUIT VENTING
WROUGHT IRON PIPE & DRAINAGE FITTINGS.

For good work both water and peppermint tests should be made and if it is desired to be absolutely certain that integrant traps of water closets, etc., are perfect a smoke test may be made after fixtures are set.

In alteration work a peppermint test must always be made.



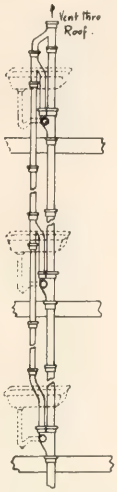


BATH ROOMS - (DOUBLE) ON ONE STACK - USING F & W. C.I. FITTINGS.

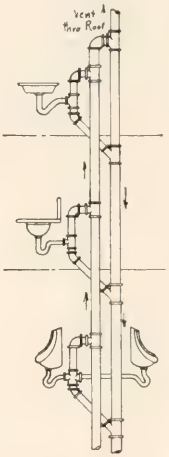
THE WATER SUPPLY

There are so many failures in the water supply system of buildings that it is evident that little study is given the problem which is one of most vital importance.

In order to provide an adequate supply of water for the particular building it is necessary to analyze the actual requirements based on a per capita consumption per day—and another factor that enters into the problem is the pressure under which the water will be delivered.



SINK STACK, USING F & W. CAST IRON FITTINGS.

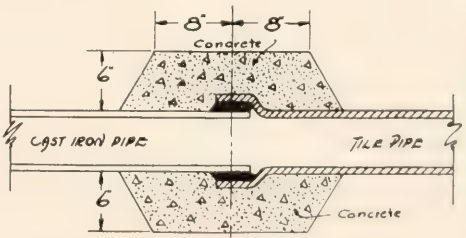


W.I. PIPE & DRAINAGE FITTINGS.

Per capita requirements may be determined by the following tables, which are the minimum:

Schools (not boarding) 50 gallons per capita per day.

Industrial Plants & Factory Buildings—50 gallons per capita per day.



METHOD FOR JOINTING C.I. to TILE PIPE.

This does not include water that may be required directly in connection with plant operation in various manufacturing processes.

Hotels, Hospitals, Asylums, Sanitariums—150 to 200 gallons per capita per day.

Homes for the Aged, Orphan Asylums, Boarding Schools—Dormitories—100 gallons per capita per day.

To the above must be added water for sprinkling lawns, etc., which must be based on the flow in gallons per minute of each ¾" lawn sprinkler installed—allowing for a

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period of 3 to 4 hours for each sprinkler as a fair average.

Having determined the total quantity required for 24 hours—the next thing to determine is the proper pressure required for the work and in working this out the following must be considered:

If the average pressure is not sufficient to deliver water on the top floor of the building under at least 20 lbs. maintained pressure, it is advisable to provide a pumping system to increase the pressure so as to maintain an average of at least 20 lbs., on the top floor.

The following tables may be used to advantage in determining the sizes of main and branch supplies for buildings:

Equalizing Table of Areas of Taps

PIPE SIZES, INCHES	½	¾	1	1¼	1½	2	2½	3	4	5
½	1	1.7	2.8	4.9	6 6	11.	15.6	24.	32.	65.
¾		1.	1.6	2 6	3 8	6.2	8.9	13.8	23.	37.
1			1.	1.7	2.3	3.8	5.5	8.5	14.	23.
1¼				1.	1 3	2.2	3.1	4.9	8.	13.
1½					1.	1.6	2.3	3.6	6.2	9.7
2						1	1.4	2.2	3.8	5.3
2½							1.	1 3	2 6	4.1
3								1.	1 7	2.7
4									1	1.6
5										1

Equalizing Table of Delivering Capacities of Pipes

DIAMETER, INCHES	¾	1	1¼	1½	2	2½	3	4	5	6
½	2 27	4.88	8.49	15.8	31.7	52.9	96.9	205	377.	620
¾		2.05	3 43	6.97	14.0	23.3	42.5	90.4	166.	273.
1			1 62	3.45	6.82	11.4	20.9	44.1	81.1	133.
1¼				1.69	2.67	5.94	11.6	23.7	47.4	78 5
1½					1.26	3.34	6.13	13.0	23.8	39.2
2						1.67	3.06	6.47	11.9	19.6
2½							1.83	3.87	7.12	11.7
3								2.12	3.89	6.39
4									1.84	3.02
5										1.65

Gallons per Minute Delivered From Circular Openings at Mains Under Various Net Pressures

HEAD, IN FEET	Pounds Pressure	DIAMETER OF OPENING, INCHES								
		¼	⅜	½	⅝	¾	1	1¼	1½	2
10	4.33					33	56	91	131	224
20	8.66	5	12	21	32	46	82	123	185	328
30	13.09					57	101	158	226	404
40	17.32	7 5	16	30	46	66	112	182	262	466
50	21.65					73	130	206	299	520
60	25.95	9	20	36	58	80	143	223	329	572
70	30.28					85	154	239	348	616
80	34.65	10	23	41	64	92	164	258	370	656
90	38 98					97	173	271	391	692
100	43.31	11.	26	46	72	104	184	288	415	736
110	47.64					109	192	300	432	768
120	51.98	13.	28	50	79	114	202	316	454	808
130	56.31					118	209	325	471	836
140	60.61	13.5	31	55	81	122	217	336	491	868
150	64.97	14.	32	57	87	126	226	353	509	904

Where the water supply from City mains cannot be relied upon as sufficient in volume or pressure to supply all fixtures in the building it will be necessary to provide for reserve storage to insure a constant supply, and there are two kinds of systems to be considered—First the one most commonly known, a tank on the roof, and the other and more recent—a compression tank system with a closed pressure tank in the basement. The roof tank system is obsolete and not recommended—for the reason that in order to maintain a pressure of 20 lbs. on the top floor it would have to be elevated 50 feet above the floor to give this result. Furthermore such tanks require special provision to be made for their support, must be enclosed and generally considered from a standpoint of efficiency vs. expenditure, are out of question at the present time.

The best system is a compression tank pumping system—which we shall briefly describe. These systems may be divided in two kinds—one where the pressure of the water is so low that all must be pumped and the other where it is only necessary to increase the pressure for the upper floors—in which case the system is known as the "booster" type.

In the first type the water may be delivered from a well, cistern or city main and depending upon the source of supply a pump designed for that special work must be used. Wherever possible, when pump is within suction lift of the water (20 feet) a centrifugal or turbine type pump with direct connected motor is the best to use. These pumps are of greater efficiency, less noisy and are more economical in operation than piston pumps.

In order to determine the proper size of pump to install we refer to the following table—which should be checked up with the per capita allowance per day previously mentioned.

To apply the above—First ascertain the number of fixtures pump is to supply—be sure to include every kind of fixture. In case any fixtures are supplied direct from city main these should be deducted. Second—Multiply the number of fixtures by the proper decimal that may apply according to the class of building.

Stores & Shops .... .75
Office Buildings .... .75
Factories 1.00
Apartment Buildings 5
Hotels 8
Hospitals 1.00
Schools 8

The above illustrations represent a few of our many designs of Bath Room Trimmings finished in Porcelain Enamel on a special metal base; Medicine Cabinets, Mirrors and Hardware in the same finish. A phone call will bring our representative to your office with samples.

American Enameled Products Co.

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The table is based upon an equal number of males and females and the figures represent the gallons per minute per fixture. If the major portion of occupants are females increase pump capacity 25 per cent.

Where more than 150 fixtures are to be supplied pump capacity may be reduced 15 to 25 per cent.

Where actual water requirements have been determined (by meter or otherwise) furnish a pumping unit capable of discharging three times the actual quantity used.

Example—The total number of fixtures to be supplied by pump in an office building is 120. =120×.75=90. Therefore 90 gallons per minute which pump must discharge. Now to determine the head—The water must be elevated 100 feet and develop a pressure of 20 lbs. The actual head therefore will be 150 feet and to this must be added the distance of suction lift, if any, and allowance for loss of head by friction in pipe. If suction lift is 20 feet—this added to 150 makes a total of 170 and allowance for friction, 10 per cent, makes a total head of 187 feet against which the pump would have to work. The problem worked out in this manner and reference to standard catalogues of pump manufacturers will enable anyone to select the proper equipment.

When the system is of the second type or "booster" system—the head against which pump will work is determined by the following method:

Pump location to highest fixture....100 feet	
Range from minimum to maximum pressure 100	"
200	"
Deduct City pressure 25 lbs. in feet —60 60	"
Pump required for a total head of..140 feet	

Compression tanks should be installed of such size that the cycles of pump operation do not exceed three to four per hour. To insure this condition the tank should have a storage capacity of 25 to 30 times the capacity of pump per minute. To illustrate for a pump of 90 gallons per minute:—30×90:—30×90=2700 gallons per tank—1/3 to 1/2 of the storage capacity of tank should be filled with air—at maximum working pressure.

Where the city pressure is not constant and less than 20 pounds, it is advisable to install a surge tank to which the suction end of the pump is connected. The suction line to be provided with a gate valve and two horizontal check valves. The supply to the tank should not be less than 2" and the supply controlled by a float valve of approved type. The storage capacity of the surge tank should be at least ten times greater than the delivery capacity of the pump in gallons per minute.

The surge tank may be of cypress or steel and provided with a removable cover and also a 2" drain connection or larger, valved and connected to sewer.

Where the city water pressure exceeds 20 pounds and is constant, the surge tank may be omitted if the pump is of the centrifugal or turbine type, and the suction pipe may then be connected to the main service direct. However, in this case, the cross sectional area of the main service pipe must be at least 50 per cent greater than the area of the suction pipe of the pump.

Suction pipe connections must be provided with two check valves and a gate valve.

For large installations duplicate pumps should be installed.

Service Connection to Building:

For water service connection to buildings under 3" in size extra strong lead pipe may be used with corporation stops and goosenecks as required by regulations of the Water Department.

It is now possible to obtain cast iron pipe, 1¼", 1½" and 2" diameter, which is made in 5-foot lengths, hub and spigot pattern, and the use of this is highly recommended for service connections instead of lead pipe. Wrought iron or steel pipe should never be used for service connections under ground.

For service connections of larger diameter than 2" cast iron water pipe in 12-foot lengths, hub and spigot pattern of proper class or weight to suit pressure should be used.

When cast iron pipe is brought into the building and up through floor, the same should terminate in a flanged end fitting about 12" above floor.

Heavy pattern stop cocks or gate valves provided with heavy tee handle operating rods should be placed on the service connection and provided with cast iron service boxes with cast iron covers. On the inside of the building the main service must be provided with gate valves and arranged for meter connection if required by the Water Department. Provision must be made for supply connections inside fire standpipes as may be required.

From this point on the supply piping should be of the following material:

Water Supply Piping:

1. Brass pipe, iron pipe size, properly annealed seamless tubing with red metal cast brass fittings for such work where the utmost durability is desired.

In some cases where it may be desired to effect some saving in cost, the hot water supply and return piping are specified to be of brass and the cold water supply piping of genuine wrought iron pipe galvanized.

It is suggested that all specifications for work of the best class be drawn covering brass pipe for the water supply lines, both cold and hot, or at least for the hot water supply and return lines, and then, if desired, an alternate bid may be asked for on the supply piping of genuine wrought iron pipe with galvanized malleable iron beaded fittings.

This will enable the Architect to take advantage of a reduction in cost if the owner desires to make such a saving, and the Architect cannot be criticized for not having specified the best material for the work.

2. Next to brass pipe the best material to use is genuine wrought iron pipe galvanized.

3. Where cost is the sole consideration and durability of not vital importance, commercial steel pipe, galvanized, may be used.

The following suggestion is made to specification writers on the subject of Genuine Wrought Iron and Steel Pipe.

Most frequently the specification states that the supply piping shall be of wrought iron pipe and this is the cause of much misunderstanding and frequently the installation of material that is not wanted.

When the phrase, "wrought iron pipe," is used, it is commonly taken for granted by plumbing contractors that the grade of pipe known as "Commercial Steel Pipe," either black or galvanized, will be satisfactory. Perhaps in many cases it will be, but it frequently happens that the Architect intended that genuine wrought iron pipe was to be used. In order to clarfiy this matter it is suggested that the specifications designate whether the pipe throughout shall be genuine, wrought iron or commercial steel pipe. In case of the former, the words should be added "with the name of the manufacturer stamped on each length."

Flanges and Unions:

All pipe up to 2½" should be provided with galvanized malleable iron unions with brass seats and all pipe over 2½" to be provided with flanged unions having gaskets of asbestos graphite packing ⅛" thick for best work and rainbow packing for average work.

Valves and Stops:

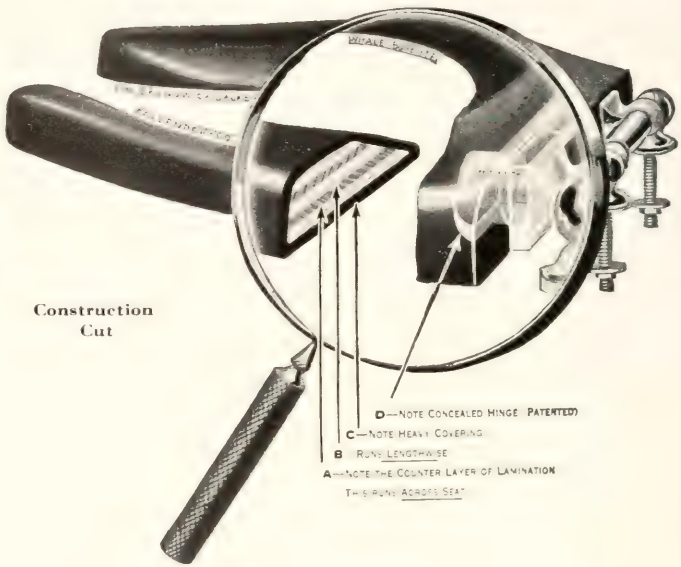
Valves should be heavy type brass double

THE BRUNSWICK-BALKE-COLLENDER CO.'S

WHALE-BONE-ITE

REG. PAT. OFFICE

CLOSET SEATS



Construction Cut

A FEW INSTALLATIONS

Palmer House
Hotel Sherman
Morrison Hotel
Allerton Hotel
Edgewater Beach Hotel
Windermere Hotel
Illinois Merchants Bldg.
Burnham Bldg.
Straus Bldg.
London Guarantee Bldg.
Tribune Bldg.
Federal Reserve Bldg.

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of no apology

Handsome appearance
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EASIEST CLEANED
Warrants Consideration at All Times

BUILT TO A STANDARD OF QUALITY
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UNQUALIFIEDLY GUARANTEED

First Cost—Last Cost

SOLD BY ALL LEADING
PLUMBERS AND JOBBERS

MADE BY

THE BRUNSWICK-BALKE-COLLENDER CO.
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gate valves up to 2½" and iron body bronze mounted flanged end for larger sizes. Valves should be of the "rising stem" type for the reason that with this type it can be quickly observed if the valve is "open" or "closed."

Globe valves of approved pattern with heavy brass body and soft rubber discs for cold water lines and composition discs for hot water lines may be used instead of gate valves on pipe from ½" to 1½". For larger pipe, gate valves should be used.

Fittings and Nipples:

Fittings for genuine wrought iron or steel water supply piping should be galvanized malleable iron beaded fittings. Plain fittings must never be used. If the pressure exceeds 75 pounds, extra heavy fittings should be used.

Nipples whether on genuine wrought iron or commercial steel pipe lines should in all cases be of genuine wrought iron. The nipple is the weakest part of any line, and for the very best work, nipples known as close or short pattern should be made of "extra strong" pipe. Genuine wrought iron nipples so stamped may now be obtained from manufacturers and makes it possible for the superintendent to assure himself that the contractor is furnishing the proper article.

THE HOT WATER SUPPLY for the building should be determined upon the actual requirements to suit the conditions of each case.

For instance—in the case of a hotel with 100 bath rooms—each containing lavatory and bath tub or shower—the demand for hot water is at a peak load—from 6:30 to 8:00 A. M. and 4:30 to 7:00 P. M. with lesser demands at noon and later at night.

To provide for such service a minimum of 30 to 40 gallons should be allowed for each bath room per hour—this with 100 rooms would mean a heater having a capacity of 3000 to 4000 gallons per hour to which must be added the quantity that will be required for kitchens, laundry, etc.

Generally speaking the following table may be used to determine size of hot water supply systems:

Schools (not boarding):

5—gallons per pupil per day for water used in lavatories,
6—gallons per minute for each shower
or
25—gallons for each pupil using the shower.

Hospital:

50—gallons per day for each person and add 50% of total for kitchen —laundry and general service.

Hotels:

50—gallons per day for each bath room and add 50% of total for general service.

If there is a Turkish bath in connection with the hotel add 100 gallons for each bather—based upon the capacity per hour of the establishment.

Apartments: Allow 100 gallons per day for each apartment having not more than 2 baths, for each additional bath add 25 gallons and 25% of the total for general service.

Factories: Allow 10 gallons for each employe per day for each wash basin and 25 gallons for each employe using showers.

Boarding Schools—Asylums—Homes, etc.: Allow 40 gallons per day for each person. For showers 25 gallons for each user and add 50% of the total for general service.

For smaller installations a hot water storage tank with steam coils for winter service and hot water heater for summer service makes a satisfactory installation. The tank should always be provided with a thermostatic control to prevent overheating the water. Tanks with coils should always have a manhole at one end.

In cases where the heating system is a **vapor** system, the water should be heated by means of a hot water heater the year around, as the pressure of the steam is too low to effectively heat the water by means of steam coils in the tank.

Where showers are used it is desirable to place a thermostatic hot water line control valve in the hot water supply main in order to prevent scalding. It is good practice to separate the system in Hotels, Hospitals, etc., so that the water supplied to bath tubs, lavatories and showers is controlled in this manner. It not only prevents possible scalding but saves fuel and increases the life of valves, faucets, etc., which excessively hot water materially shortens.

In larger installations—especially where both exhaust and live steam (high or low pressure) are available; the hot water system should be arranged in two units; the first a storage tank of proper size, called the primary heater, in which the water is heated by exhaust steam—from this heater it passes to the secondary heater which is provided with coils supplied by live steam under thermostatic control. The latter heater brings the water up to the desired degree of temperature at which the control is set.

Another and most economical type of heater is the instantaneous type—heated by low or high pressure—controlled by an automatic thermostatic device and using only such quantity of steam as necessary to heat the water actually used—to the temperature for which the control is set. This type of heater is very efficient and economical and is especially adapted to large installations as Hotels, Hospitals, Factories and wherever there may be a large variation in the demand for hot water throughout the day or night.

In order to ensure proper results, hot water systems must be in perfect circulation —wherever possible the **overhead** type system should be used with a riser to the top floor—horizontal supply mains and drop supplies to the fixtures on floors below with circulating return in basement. Hot water riser should have an air vent trap at highest point.

Pressure of hot and cold water systems should always be the same.

In some cases circulating pumps are necessary. These should always be of the centrifugal type with low speed motors and if direct current is available, motors should be provided with a variable speed control.

In conclusion of the suggestions for water supply system—I would say that in my experience most mistakes have been made in having the piping system too small and this is especially true in the case of hot water tanks and heaters.

A heater too small for the service will waste more fuel than one too large.

ARRANGEMENT OF TOILET ROOMS AND PLUMBING FIXTURES.

Few Architects realize how much the cost of the plumbing and heating on a building is governed by the design and location of toilet rooms. Many buildings are up several stories before the location of pipe chases or shafts are decided upon and many botched up piping jobs are the result of this neglect.

This again brings up the great need of proper plumbing plans and diagrams—showing the proper size and location of the piping and permitting the general contractor to provide chases in walls—leave openings in floors and provide pipe shafts of proper size for the work.

In residences with wood studs the partition carrying soil pipe must have at least 6" studs and a still better arrangement is to have a hollow space and use 4 or 6" studs flat wise and framed once or twice in their height as this saves cutting of studs for horizontal vent pipes.

If partitions are hollow tile, 6" thick tile should be used. Thin partitions of Mackolite, Pyro Bar or similar gypsum materials make

NIEDECKEN SHOWERS

Patented

N. C. 1100

THE FLOW CONTROL

Regulates the flow or pressure of water from the shower head. All NIEDECKEN Showers are furnished with Flow Control.

N. C. 1100 NIEDECKEN SHOWER

One-half inch concealed type NIEDECKEN Mixer, 4-inch cast brass adjustable shower head, Flow Control, china dial and handle.

NIEDECKEN MIXER

Patented

Dial removed. The only tool required to take the MIXER apart is a screw-driver.

Cover removed, giving access to valve discs and seats.

Replacing valve seats.

NIEDECKEN SHOWER STALL

Patented

ABSOLUTELY LEAK PROOF

The walls of the stall are made of a continuous sheet of No. 10 gauge copper bearing steel which with the riser are welded to a dished bottom with waste outlet in center.

The equipment consists of a special concealed type Niedecken Shower, with 4″ cast brass ball joint shower head, flow control, curtain rail, duck curtain and nickel plated strainer arranged for 2″ waste outlet, for either lead or iron pipe.

The shower is placed on the side and near the front to enable the bather to adjust for water temperatures before entering the stall.

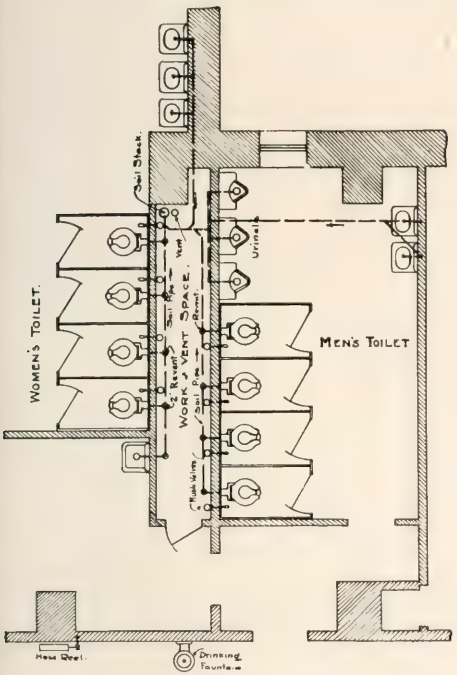
After installation is completed, the interior and exposed exterior of the stall should be finished in white or tinted enamel paint and the bottom in gray.

Write for Bulletin H.A:B. 22

HOFFMANN & BILLINGS MFG. CO.
MANUFACTURERS SINCE 1855.
MILWAUKEE. U. S. A.

very unsatisfactory partitions for concealment of piping, as no secure anchorage can be had in same for bolts to fasten hangers or brackets for fixtures; furthermore, condensation on pipes dissolves sulphuric acid in gypsum and induces quick corrosion of metal.

With buildings of fireproof construction in which the floors are of reinforced concrete



Toilet Rooms with Work & Vent Space between same.

the location of bath and toilet rooms must receive careful study.

There are three schemes that may be used.

The first, a pipe shaft 2'-6" to 3' in width extending up through the building—in which all piping may be placed and fixtures all provided with wastes and supply connections to wall. (See illustration.) This arrangement is very desirable for Hospitals, Schools, Hotels, Office Buildings, etc.; it makes an ideal arrangement and is economical in cost of installation and maintenance. All pipe being exposed it is easily gotten at in case of repairs.

The second is to raise the floor of toilet rooms 7" to allow for piping being concealed in floor. This is sometimes objectionable and in the case of Hospitals, Homes and Institutions should not be done.

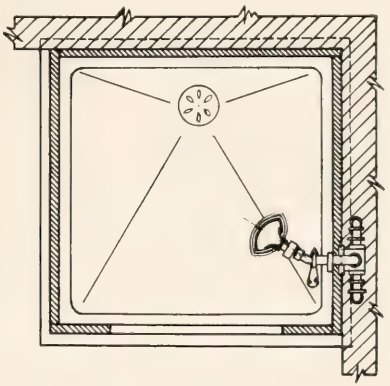
The third is to run the piping under the ceiling of room below—either exposed or concealing the same by furring down the ceiling.

In planning toilet rooms it is most important to ascertain the exact size of the various fixtures that are to be installed—so that these will be placed properly and to the best possible advantage.

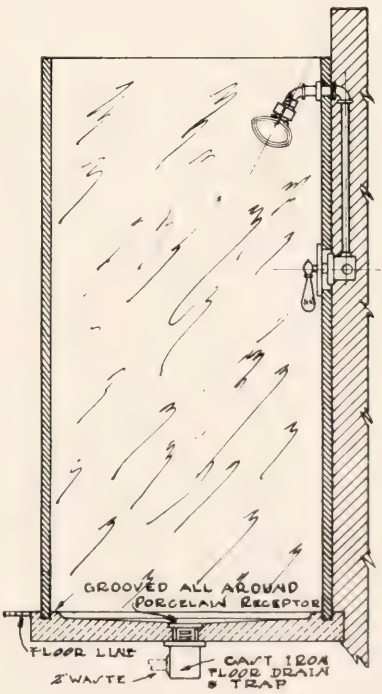
This is especially necessary in the case of bath tubs and shower stalls. If recessed tubs are used, the exact length overall, distance the ends and back will extend into wall must be considered as there is always a difference between the nominal size of bath tub and their actual overall length; the end at which the waste and supply fixtures are to come should be shown and a paneled door of proper size provided so that the fittings can be properly installed and accessible in case of repairs. When recess tubs are used—it is always desirable to tile around the top of tub, as this makes a more permanent installation than a finish of hard plaster.

Shower stalls should never be less than 3'-0" x 3'-0" inside for a comfortable stall. 3'-2" x 3'-2" is the standard size adopted by plumbing manufacturers and should be used wherever possible. Stalls should be at least 6'-6" high. Solid porcelain receptors, grooved to receive marble partitions are the best and are absolutely leakproof. If marble floor slabs are used they must not be less than 2" thick and should be grooved all around to receive marble partitions.

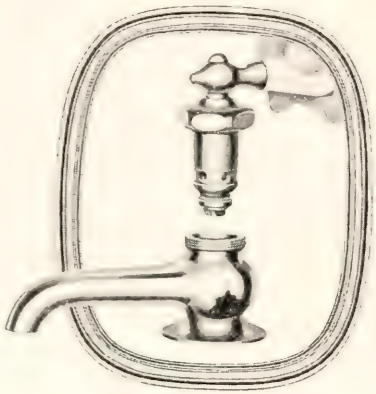
The placing of sheet lead flashing underneath marble shower slab or tile for shower stalls on upper floors has been discontinued for the reason that very often the weight of the stall above same cracked the sheet lead

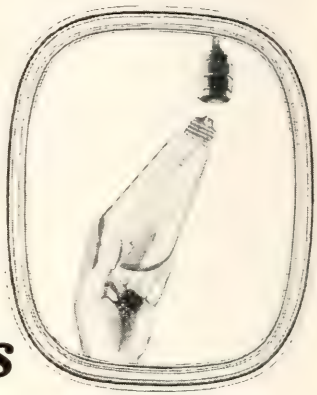


PLAN



SECTION





Leaking faucets and burned-out bulbs

WHENEVER a faucet starts leaking, a MAJOR OPERATION is required to stop it. When an electric bulb burns out, anyone can tend to that.

The main reason why building managers and engineers and home owners appreciate Chicago Faucets is because anybody can repair a leak in a minute or two. Chicago Faucets have a standardized working unit that fits every faucet. It is almost as easy to remove this and substitute a fresh one as it is to replace a burned out bulb in a light socket. There are only two wearing parts —seat and washer—and both are easily replaceable at a cost of a few cents.

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Let us send you our catalog and a cut-out sample of a Chicago Faucet showing this everlasting unit construction.

THE CHICAGO FAUCET COMPANY

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CHICAGO FAUCETS

so that the installation of same as a means to prevent leaks—was a useless expense.

The best material to use for water proofing under marble or tile shower slabs is to build up three or four thicknesses of genuine asphalted felt well lapped and swabbed with asphaltum and the edges of the felt turned up at least 6" high at side walls. This is an inexpensive method and far more satisfactory than sheet lead.

A word of caution in connection with the kind of material to be used for shower stalls. Marble, slate, vitreous tile and salt-glazed brick are recommended as suitable, but the use of steel for shower stalls whether galvanized or painted is not recommended for the reason that it is not durable and its corrosion is only a question of time.

It is desirable to place the controlling valves to shower head on one side of the stall near the entrance (see adjoining illustration), so as to permit the water being turned on and tempered without wetting the bather. When a stop valve is placed in the supply to the shower head, it will be necessary to provide the hot and cold water supplies with check valves to prevent the by-pass of water from either side in event that the valves on inlet of shower are not entirely closed. When there is no valve between the inlet valves and the shower head, check valves are not absolutely necessary.

All shower heads should be placed 6 feet above floor for adults and 5' 6" for school showers provided with an adjustable ball joint by means of which the angle of the shower head may be changed as desired. Shower heads arranged in this manner give better results and will not wet the bather's head unless he so desires.

When thermostatic or anti-scalding shower valves are used, it is always desirable to place on the hot and cold water supply line for each, a loose key compression shut off by means of which the supply can be controlled, which is necessary if the pressure is very high or the pressures of hot and cold water are not equal.

When plain compression type control valves for showers are used in place of thermostatic or anti-scalding valves—a thermostatic hot water control valve should be placed on the hot water supply line to the showers and set so as to prevent the hot water exceeding 110° F. in temperature.

The placing of plumbing fixtures against outside walls should be avoided. It is very unsatisfactory. Even if the supplies are carefully covered there is always danger of freezing. The custom of placing bath tubs under outside windows is most objectionable. This has been commonly done in apartment house work. A little study of grouping would have produced better results.

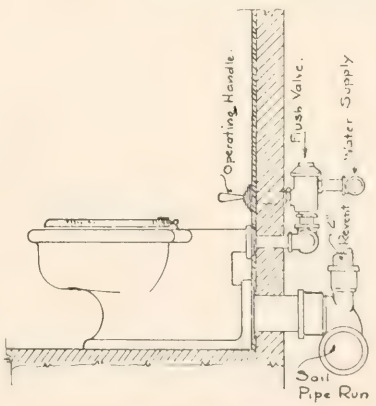
In public toilet rooms the arrangement of water closet stalls must be well considered. Where a number of these are to be installed the size of the stalls must be determined. The adopted standard width is 2'-6" centers for schools—they should not be less—but may be more. For adults the stalls should be 2'-10". Three (3) feet is the greatest width that should be used. To make them wider would be waste of space. The depth inside should not be less than 4'-6" with doors swinging in. This depth will allow the standard width—2 foot door to well clear the front of the closet bowl.

In factory, etc., and school work, especially primary grades, it is better to omit doors entirely and in this case the stalls need not be more than 3 feet, or at the most 3'-6" in depth.

If possible all flush tanks, piping, etc., should be concealed in a work space in rear of closet stalls. The wall of work space being formed by the backs of partitions or a built up wall as desired. Frequently this same work space is also utilized as a vent space, providing the back of each stall with a vent opening, protected by a ventilating hood or register face. This makes a most desirable arrangement for ventilating large toilet rooms—especially adapted for schools, asylums and all public toilet rooms.

The water closet stalls may be of marble, slate or steel according to the class of work. Steel partitions are very satisfactory and excellent for school and factory work.

The bottom of all partitions should be 12 inches above the floor. When marble is used the pilasters should be 1½ or 2 inches thick and grooved to receive the partitions. The backs should be cut out to receive the partitions and a top rail of marble corresponding in thickness to the pilasters and 3½ or 4" high extend along the entire front. The bottom of rail should not be less than 6'-6" high for schools and 7 feet for public toilet rooms. This arrangement does away entirely with brass floor and top standards and



WATER CLOSET. WALL OUTLET.

all metal angles—very desirable for the reason that nickel plated brass work becomes tarnished very quickly and is rarely given the care it requires to keep the same in good condition.

If wood doors are used they should preferably be of the type known as "sanitary", perfectly flush without panels. The standard

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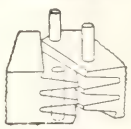

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size is 2 feet wide, 5 feet high and 1⅛" thick. They should be provided with an adjustable N. P. box spring hinge and blank with check, door latches and stops and should always swing in, with spring set to hold the door open when not in use.

While on the subject of water closet stalls a word of caution regarding the floor is apropos. It frequently happens, especially in school and factory work, that the floors of toilet rooms are pitched toward a floor drain and whenever this is done the contractor doing the flooring work should be cautioned to keep that portion of the floor on which the water closets are to set perfectly level and establish his break line at least 3 inches forward of the front of the base of the water closet bowls. Unless this is done the plumber when setting the bowls will level them up with cement in order to obtain an even bearing and the cement under the base of the bowls either causes them to crack on account of unequal expansion and contraction or because of improper support throughout the entire base, the unequal strain on the ware will cause cracks.

For connecting water closets with floor outlets to soil pipe or fittings only cast iron bends of an approved type should be used—with a gasket of asbestos, graphited.

Connection between waste outlets of water closets with wall outlets and soil pipe should be made by means of heavy combination lead and iron ferrules, one end caulked into hub of cast iron fitting, the other wiped to a brass closet flange and asbestos graphite gasket.

This method of connection does not cover the wall hung type closets now being used of which each special type is provided with a special designed form of attachment to the soil pipe or stack.

Now as to the type of water closets to be used. There are today practically only two styles—one known as a siphon jet bowl, the other a washdown with jet. There are of course a large number of various special type bowls in the market but they are modifications of the above types.

The siphon jet bowl is the best to use on account of its more quiet action in flushing and also for the reason that the interior of the bowl presents less fouling surface, owing to the larger water surface.

The greater the cross-sectional area of the siphon limb the better the operation of the bowl. The minimum diameter of the siphon limb should be 2½" and 3" is better. The more uniform the passage is the less danger of stoppage. All bowls should be tested out under water before shipment by the manufacturer—for two reasons: one to determine whether the ware is free from cracks—called "dunts" by the potteries, the other to be certain that the construction of the bowl is perfect.

In many localities the water contains incrusting ingredients that may cause clogging up of the jet tubes in time. Such conditions may be remedied by emptying the water contained in the bowl and pouring a pint or more of "Commercial" Muriatic acid into the bowl. The acid will dissolve the solids in the jet opening in about ½ to ¾ of an hour.

However, where the water is extremely bad—it is advisable to use the washdown type of bowl with jet, which is not as apt to become stopped up as the jet openings are larger than in the siphon jet type and the tube has no pocket in which deposits can accumulate.

Where it is necessary to practice economy in the selection of fixtures—it is advisable to use washdown water closets with jets. For Schools and Factories this style is generally used.

There is another type of closet used today which is a composite of the siphon jet and washdown bowls. This bowl is known as the "reversed trap type" and when correctly designed and properly made, makes a very satisfactory closet. It has less fouling surface than the washdown bowl and is siphonic in action.

The conditions that are to be met in each case must necessarily determine the particular kind of closet that should be used. Also whether the bowls should have extended lips, floor or wall outlets, have low down tank, or flush valves or flushed automatically by seat operating valves. No fixed rule may be prescribed for such selection, which can only be made according to requirements of the work itself.

In the selection of water closets consideration must be given as to the manner in which the closets are to be flushed. Water closets with high tanks or low down tanks require a ½" supply connection, whereas these fixtures if operated by means of flush valves—require 1 to 1¼" supply connections to each flush valve. Water closets with automatic seat operating valves require ½" supply connections as a rule.

Where there is more than one water closet in a row or battery, the main supplies for such battery must be of a size that will adequately supply all fixtures. Reference to the following table will be of service:

Table of Branch Supplies for Water Closets.

The following table will be of service to determine the proper size of branch supplies for water closets from 1 to 12 fixtures in a battery. The size of pipe is based on a pressure of from 20 to 40 pounds.

For Automatic Seat Operating Water Closets or Water Closets with Low-Down or High Tanks. Inlets ½".

Number of Closets	Size of Branch, Inches
1	¾
2	¾
3	1
4	1
5	1¼
6	1¼
7	1½
8	1½
9	1½
10	1½
11	2
12	2

Each branch connection to closet valve or tank shall be ½ inch.

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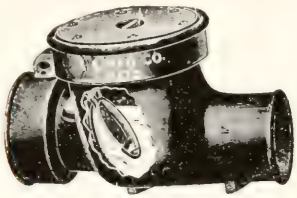
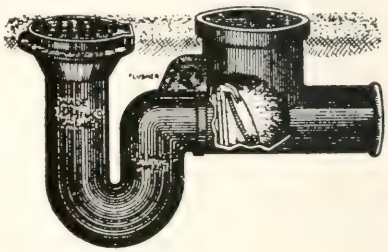
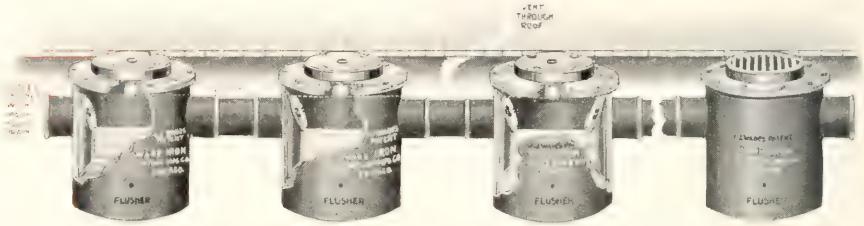


C-Fig. 1.
Wade Accessible flushing backwater valve for prevention of flooded cellars.

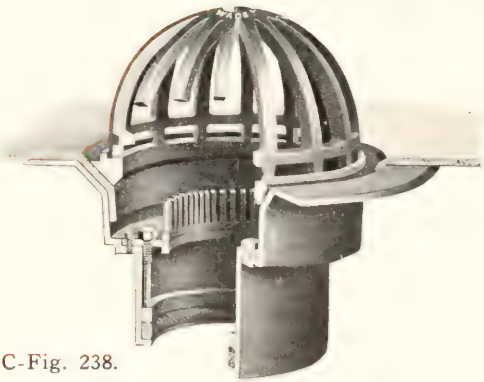
Automatic Electric House Pumps



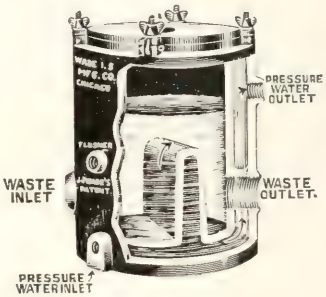
C-Fig. 18.
Floor drain and backwater valve.



C-Fig. 37. Oil separator for garages.
C-Fig. 37½. Floor drain basin.



C-Fig. 238.
Roof downspout head.



C-Fig. 27.
Water jacket grease basin.

Send for catalogue.

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For Water Closets with Flush Valves Having 1¼" Inlets.

Number of Closets	Size of Branch, Inches
1	1¼
2	1½
3	2
4	2½
5	2½
6	2½
7	2½
8	2½
9	3
10	3
11	3
12	3

Each branch connection to flush valve shall be 1¼ or 1 inch, according to style of valve used.

Refer to table of "Delivering Capacities of Pipes" on Page 511 for sizes of branches where inlets are other than ½" or 1¼".

The water pressure must also be carefully considered for flush valves and automatic seat operating valve closets. For the former the minimum should be 15 lbs., and for the latter 20 lbs., at each bowl.

Consumption of water is another item to be considered. Tank closets will use 6 to 8 gallons per flush: those with flush valves from 6 to 8 gallons according to the pressure and automatic seat operating closets will only use 2½ to 3 gallons per flush.

Now regarding urinals—At present there are four types. The solid porcelain urinal 18 and 24" wide which sets into floor and has a lipped extension base the top of which is usually set flush with floor. Then there is the old style wall hung urinals—either washdown or siphon jet type. The enameled trough urinal and the slate or marble ventilated stall urinal with porcelain trough gutter set in the floor.

The first type mentioned is the one most generally used except for factory and school work. For the latter work the slate or ventilated stall urinal has several features in its favor. It is less expensive than the solid porcelain urinal and when equipped with a proper flushing device and a deep porcelain gutter carrying not less than 2" of water which is automatically flushed out periodically, makes a most sanitary fixture. The urinal is the most objectionable of all plumbing fixtures and unless it is properly ventilated and gutters contain a sufficient quantity of water for proper dilution of the urine, the fixture becomes a nuisance.

The Chicago ordinance does not permit of a urinal with gutters in the floor and I believe this a serious oversight. It permits of the use only of the solid porcelain, wall hung or lipped trough urinals. The two latter types are unquestionably inferior from a sanitary standpoint to a slate or marble ventilated urinal with a solid porcelain gutter and siphon trap.

When setting solid porcelain urinals into the floor a depth of 4" is required to bring the top of the drip receptor flush with the finished floor. Care should be taken to set these in accordance with instructions of the manufacturers. They must never be solidly set in a cement grout; an inch or more of dry sand should be put under same and a strip of expansion joint composition placed on the front edge and exposed sides so the concrete sub-base of floor will not adhere. The finished tile, terrazzo or cement may be run up against the porcelain ware.

Regarding the other fixtures such as lavatories, sinks, slop sinks, etc., space will not permit going into details. The catalogues of manufacturers generally give all information necessary regarding same.

The only question of material interest to the Architect regarding these is the kind to be used. This in a measure may be determined by the class of the work itself.

For lavatories for first class work—only those of the best vitreous ware should be used. These are made in many styles and sizes. Enameled iron lavatories are not as desirable as those of vitreous ware.

For sinks—there are a large variety—solid porcelain, vitreous in certain sizes, enameled iron; slate, alberene stone and copper, "Liberty" silver and galvanized steel. Each has its especial field and the kind and size must be determined for each class of work.

Brass Goods:

In order that the Architect may be assured of obtaining durable material great care should be used in the selection of the brass goods which include faucets, bibbs, stops, and supply piping for lavatories, bath tubs, showers, sinks, etc.

For first class work the following clause should be inserted in the specification.

"All brass work shall be red metal brass of a composition in accordance with the Navy Department standard—which is 85% copper, 5% tin, 5% zinc and 5% lead. All tubing such as flush pipes, etc., shall not be less than No. 14 gauge and all supply pipes shall be full iron pipe size, annealed, red brass. All nickel plated work shall be of the highest quality and subjected to the nickeling process for a period of not less than one hour. All faucets, valves and bibbs shall be provided with stems having movable loose discs. Discs to be of special hard fibre and not so called composition and all discs must have edges encased by a brass protecting rim.

"For all concealed valves or stops the operating part must be removable from face of wall and the discs the same as above and the seats of removable, renewable, type."

While on the subject of stops a few words are apropos. The supply connections to every fixture should be provided with stops either exposed or concealed type. The initial cost of stops is very small when compared to the cost of repairing damage to floors, plaster, ceiling and decoration caused by leaks.

Cost today, more than ever, is an important factor in considering the quality of plumbing fixtures that should be used. However, it would be very poor judgment to sacrifice quality of material in any line on account of cost. The work of the Architect is not for today, but for tomorrow, and he who builds well in all things will profit more than one who builds poorly, and hence, now more than ever skill in design and knowledge of materials and their proper use will be required of the Architect to secure results.

Nothing will cause as much annoyance and require as constant repairs as a poorly designed and cheap installation of plumbing. Repair bills are a constant reminder to the owner of mistakes made by the Architect, who failed to give in full the service for which he was paid.

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ULTRA VIOLET RAYS FOR STERILIZATION OF WATER

By G. R. SHAW

It has long been known that light has bactericidal properties and a paper given in 1877 before the Royal Society of London by Downes & Blunt called attention to the fact that direct and even diffused sunlight has the power of killing the bacteria of putrefaction. It was shown that the most active rays were the blue, violet and ultra violet frequencies and that heat rays played no part in this action.

In 1892 Professor Marshall Ward with Sir Oliver Lodge conducted tests using the electric arc and exposed culture plates to the ultra violet energy as well as to the energy of other parts of the spectrum and showed conclusively that the ultra violet produced powerful bactericidal action.

It was not until 1910, however, that elaborate experiments conducted at Sorbonne University, Paris, by Henri, Helbronner & Von Recklinghausen led to the development of an apparatus for the use of ultra violet rays in the treatment of water. These experiments resulted in the first commercial use of this process of water treatment and in 1912, the first commercial installation was made in this country. Since that time the apparatus has been developed and improved so that today it is being used with distinct success on drinking water supplies, bottling plants and swimming pools and in fact is suitable for any use where a water is desired that is free from pathogenic or disease producing bacteria. In its present state of development it is capable of taking care of capacities up to 150,000 gallons per hour.

All light is vibration and lights of different colors have different wave lengths or intensities of vibration. The white light of the sunlight is composed of lights of many colors each of different wave length, as seen in the rainbow or spectrum. These colors range from red, which has the longest wave length of the visible colors, through orange, yellow, green, blue to violet which has the shortest wave length of the visible colors. Beyond the visible red are rays called infra-red which are invisible and of greater wave length than the visible red. These are heat giving rays and do not have power of bactericidal action. Beyond the visible violet lie the invisible Ultra Violet Rays which are of extremely short wave length and most intense in their vibrations. To the rays of the Ultra Violet frequency is due the bactericidal action which is utilized in the treatment of water as well as used extensively in therapeutic work. The light rays richest in the production of ultra violet are those having a wave length of about 1849 angström units (one angström unit equals one ten millionth of one centimeter). It is to these rays in the sunlight that its purifying power is due.

The rays of the ultra violet frequency are amazingly destructive to germ life though the exact action responsible for these results is not known. An investigation conducted by Prof. W. E. Burge at the University of Illinois presented evidence that ultra violet radiation killed living cells by coagulating their protoplasm. Other theories also have been advanced but nothing definite as to the exact action has been determined except that the pathogenic bacteria are almost instantly killed upon exposure to ultra violet radiation and if not instantly killed are so inhibited that their powers of reproduction are removed.

The sun is the great source of ultra violet radiation. In rarified atmospheres this is particularly noted but due to the atmosphere surrounding the earth a great deal of it is filtered out before reaching the earth's surface. Small amounts of ultra violet are produced by practically all artificial light sources but at the present time the most successful method of producing these rays in intensity sufficient to be utilized commercially is by means of the mercury vapor quartz lamp.

The mercury vapor quartz lamp consists essentially of an arc produced across mercury vapor in a vacuum enclosed in a quartz tube. (Illustration). The lamp has a straight quartz tube with a bowl at one end partially filled with mercury. The straight end of the lamp is the positive or anode connection while the bowl end is the cathode or negative connection. Mercury is a conductor and when the two ends of the lamp are connected in an electric circuit and a mercury bridge formed from the positive to negative connection electricity flows through the mercury. To produce the Ultra Violet Rays it is necessary to form an arc in the vacuum which is done by slightly raising the straight or positive end of the lamp either automatically or by hand, thus breaking the mercury bridge and producing a short mercury vapor arc. As the arc heats up it gradually vaporizes some of the mercury and forces the balance up into the bowl until in a few minutes no mercury is left in the stem. The mercury vapor arc then extends the whole length of the tube and Ultra Violet Rays of great intensity are produced.

The lamp for the production of ultra violet radiation must necessarily be made of quartz (fused rock crystal) as this is the only known solid substance except ice through which ultra violet rays will pass without losing their intensity. Glass which is transparent for visible light is opaque to ultra violet and while the standard mercury lamp used for illumination will produce ultra violet radiation still none of the rays are radiated due to the lamp being made of glass. The mercury vapor quartz lamp is particularly rich in the production of ultra violet rays of a length of 1849 angström units (.0001849 centimeter) which have been shown to have extremely high bactericidal power.

Though Ultra Violet Rays will exterminate germ life through a considerable distance naturally the nearer the bacteria are brought to the source of the rays the shorter the period required for extermination. In the types of apparatus using the Ultra Violet Ray for water treatment the construction is so arranged that not only is all of the water passing through the apparatus forced to flow near the lamp in a thin film, but it is continuously exposed to the rays and is also

continuously stirred or turned over so that all surfaces of bacteria are exposed to the rays. The apparatus briefly consists of a mercury vapor quartz lamp set in a water compartment so arranged that the water, always exposed to the rays, passes around or near the lamp in a thin film.

One type of the Ultra Violet Ray Water Sterilizer is illustrated. This is a pressure type apparatus and may be used in any supply line with pressures up to 75 lbs. per square inch. These units may be used separately or connected together in series depending upon the capacities desired, the water passing through each unit successively and being exposed to ultra violet radiation in each unit. For capacities of from 10,000 gallons per hour up, a pressure type is made which is so arranged that as many lamps as required may be connected together in series. A gravity type is also made primarily for use

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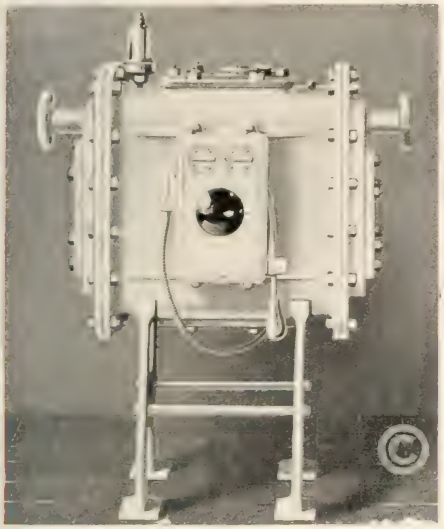
on swimming pools where it may be faced with tile to harmonize with the surroundings and give an artistic effect to the pool room. This type is not suitable for capacities over 8,000-10,000 gallons per hour on account of the gravity flow.

In all types the mercury vapor quartz lamp is suspended through the center of the apparatus and is kept from direct contact with the water by a protecting quartz tube which is fixed in the body casting and packed against external water pressure. Baffles are so arranged that the water is directed around the quartz tube and agitated so as to ex-



pose all surfaces of bacteria to the rays. Suitable tilting mechanism for starting the lamp as well as the necessary apparatus for controlling the electrical supply is furnished complete with each unit.

The mercury vapor quartz lamp used in the water sterilizer apparatus operates only on 220 volt Direct Current and where this is not available at the installation site a motor generator set is used to deliver the necessary 220 volt Direct Current from whatever current is available. The operating characteristic of the lamp at efficiency is 160 volts at 3½ amperes, the balance of the incoming 220 volts being taken up in ballast resistance. The current consumption of each lamp used is therefore .77 K. W. per hour.

The Ultra Violet Ray process has a distinct feature in water treatment in that elimination of the bacteria is accomplished without adding any substance to the water or changing its character in any way. Sterilization is accomplished simply by passing the water through a field permeated by ultra violet radiation and bacterial elimination results from exposure to the rays. If the water is passed through within the rated capacity of the apparatus complete pathogenic bacterial elimination is accomplished regardless of the extent of the contamination in the raw water. Thus the unreliable human element with the uncertainty of the proper regulation for the correct amount of dosage of the sterilizing agent is entirely removed from the process.

On swimming pools the ultra violet ray process has a distinct field as the apparatus is installed on the circulating line at some point between the filter and the inlets to the pool so that all of the water on every recirculation is forced to pass through the sterilizer and is delivered to the pool free from all bacterial contamination. Given proper distribution and turnover it has been possible for pools equipped with the ultra violet ray sterilizer to operate for long periods of time without completely emptying and refilling the pool with fresh water while bacteriological analyses have shown the water to be free from pathogenic bacteria and of the highest standard of purity. Such results show great savings in operating costs due to the saving on water and heat while the operator has the added assurance that the health of the patrons is safeguarded to the best of his ability. W. F. Walker (Department of Health—Detroit) states in the April, 1922, issue of American Journal of Public Health "Sterilization by ultra violet rays of swimming pool water in a recirculation system properly designed and operated gives a water which compares favorably with the government standard for drinking water."

The use of ultra violet rays is ideal for the treatment of drinking water supplies as well as water for bottling plants as the water is automatically treated and delivered from the sterilizer outlet free from any disease producing bacteria and still retaining its original body and snap without any change in the taste or chemical composition. Investigations of record show that the ultra Violet Ray process when properly applied eliminates the dangers of aftergrowths in the water treated which is so commonly found in waters treated by chemicals, particularly where the chemical dose has been too small for the amount of contamination and organic matter in the water. It is particularly noted that even the hardy spore forming bacteria are killed by exposure to ultra violet rays. This feature of the ultra violet ray process is particularly advantageous to the operator as the human element with its uncertainty, forgetfulness, error in judgment and often lack of skilled knowledge is entirely eliminated from the process. As nothing is added to the water no objectionable tastes or odors can be imparted. No mixing is required which can cause poor results due to insufficient contact with the bacteria. The process is automatic in its action and when operated within its capacity on a water free from sediment visible to the naked eye will produce positive results.

After repeated tests by the United States Public Health Service methods of water treatment the Ultra Violet Ray process was approved for use on the drinking water supplies on boats operating on the Great Lakes. These installations are very carefully watched by the Public Health Service and every boat must show a water conforming at all times to the standards of bacteriological purity as adopted by the U. S. Treasury Department. The fact that the Ultra Violet Ray process is in use on the majority of large passenger boats operating on the Great Lakes and continually under the strict supervision of the U. S. Public Health Service indicates the efficiency of the process.

For bottling plants the Ultra Violet Ray Sterilizer may be installed directly on the main water supply line, insuring to the bottler that all of the water used in the plan, whether product water or water used for the final rinse of the bottles, is free from any disease producing bacteria that might contaminate his product and result in a loss of revenue or possible claims due to sickness resulting from the impure product. Many prominent bottlers are using this process with distinct success.

The Ultra Violet Ray Process for sterilization of water is in its infancy but the many successful installations on municipal water supplies, private water supplies, swimming pools and bottling plants show its worth and the positive results obtained with the automatic action and ease of application should recommend it to anyone interested in the supplying of a water free from any disease producing contamination.

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PROPER PROPORTIONING OF SOILWASTE AND VENT PIPES IN PLUMBING SYSTEMS

BY THOS. J. CLAFFY

This article is written with the object of presenting information in a convenient form relative to pipe sizes in plumbing systems, for the benefit of those who are interested. More detailed information may be obtained in the report of the Committee, hereafter referred to.

It has long been a recognized fact that definite information was lacking on which to base proper pipe sizes for soil, waste, drain, and rain water pipes within buildings. Architects and Engineers especially have been aware of the lack of uniformity in design and method of installing fixtures and piping systems in plumbing.

The war hastened a concentration of forces to bring about standardization in this respect. Early in 1921, Secretary of Commerce Herbert Hoover set in motion the work of a Committee appointed to bring about a standardization of building practices. Sub-committees were appointed, and the work of bringing about more uniformity of design and practice in plumbing was allotted to a sub-committee composed as follows:

George C. Whipple, Chairman,
Professor of Sanitary Engineering,
Harvard University.
Harry Y. Carson, C. E.,
Research Engineer, American Cast Iron Pipe & Foundry Co.,
Birmingham, Alabama.
William C. Groeniger,
Consulting Sanitary Engineer,
Columbus, Ohio.
Thomas F. Hanley,
National Association Master Plumbers,
Contracting Engineer, Chicago, Illinois.
A. E. Hansen,
Hydraulic and Sanitary Engineer,
New York City, N. Y.
James A. Messer,
President, James A. Messer Company,
Washington, D. C.
Albert L. Webster,
Consulting Engineer,
New York City, N. Y.
William J. Spencer,
Secretary-Treasurer, Building Trades Council,
American Federation of Labor, Washington, D. C.

Meetings were held at Washington, and after being duly organized, the Committee decided that its first duty was to define "plumbing." The discussion leading up to this is well worth reading. The definition is:

"Plumbing is the art of installing in buildings the pipes, fixtures, and other apparatus for bringing in the water supply and removing liquid and water-carried wastes."

Why is plumbing, and why legislate for its proper installation?

It is conceded that life in American cities is practically intolerable without a water supply and water-borne waste carriers in buildings, hence the definition just quoted.

The Committee's report says that—

"The air in sewers and drain often contains gases resulting from the decomposition of excreta, soap, fats, and other wastes, together with gases from mineral oils which may come from garages, streets, and industrial establishments. Illuminating gas may also find its way into sewers through leakage. Among these gases may be found methane, sulphuretted hydrogen, and carbonic oxide. In large amounts these gases are poisonous to the human system, and there are physiological objections to breathing them even in small quantities. Hence, the air of sewers or drains should be kept from entering buildings intended for human habitation or occupancy by the use of proper plumbing installations and by suitable ventilation of the rooms or compartments in which the plumbing fixtures are located. The smell of these gases and other emanations from decomposing organic matter is naturally repugnant to human beings. It not only offends the sensibilities, but may produce shallow breathing, headache and even nausea.

"In addition to the above facts, it is important to consider the bacteriological aspects of sewer and drain air, a subject upon which there has been some misunderstanding. In recent years bacteriologists have made studies which have thrown light upon this subject. They have shown by experiment that while sewage often contains disease-producing bacteria derived from human excreta and body wastes, these bacteria are rarely found in the air which escapes from sewers and drains. Hence, it has been argued by some that escaping sewer air has no influence on health. The committee does not agree with this conclusion. Health may be influenced by factors which do not cause specific diseases, for there are chemical and physiological as well as bacteriological factors involved. The investigations thus far made by bacteriologists should be considered to be merely a beginning of larger and more complete investigations, which will doubtless be made as the science of bacteriology advances. The committee is of the opinion, therefore, that until further light on this somewhat obscure subject has been obtained, the escape of sewer air from the house-drainage system, at frequent intervals or in considerable quantities, threatens the health of the building's occupants.

"The temporary losses of water seal in traps, which rarely occur and which are immediately replaced, do not involve any great danger to the health of the occupants. * * * * * but where a loss of seal is likely to be of frequent occurrence and not readily replaced, or where breaks in the system admit sewer air continually to a building, the health of the occupants is subject to the dangers heretofore described.

"For the above mentioned reasons, regulations governing the installation of plumbing have been established by law in many places. These regulations have been potent in improving living conditions throughout the country; in fact, they have even set the standards for those places where plumbing is not under public control.

"The committee believes that good plumbing is a matter which concerns health. Government has the right to protect the people's health, * * * * *"

This is the basis upon which is built all laws, rules, and regulations concerning plumbing installations within buildings.

The National Plumbing Code, prepared and submitted in the report of this Committee, is well worth a place in every architect's library. It is designed so as to apply in every part of the United States, and is national in its scope. The primary object was to standardize plumbing in small residences. That this has been well done is obvious.

In the studies of cause and effect of air movements, carrying capacities, and the effects of corrosion in soil and waste pipes, much information was obtained which determined the basis upon which were built the following tables of pipe sizes. This has been an aggravating problem for years, and the work of this Committee will be appre-

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ciated by those who have been obliged to grope in the dark, or who have learned by bitter experience how difficult it is to carry water and eliminate air pressure in the same pipe.

EXPERIMENTS

Numerous practical experiments were carried out by the Bureau of Standards at Washington and by the Department of Sanitary Engineering at Harvard University, which aided this Committee in forming its conclusions. These experiments confirmed the findings of those whose experiences in tall building construction have been previously related.

The tables of pipe sizes are on a fixture unit basis, which is the most convenient form to use.

TABLES OF PIPE SIZES

"**Fixture Unit:** The following table based on the rate of discharge from a lavatory as the unit shall be employed to determine fixture equivalents:

	Fixture Units
One lavatory or wash basin	1
One kitchen sink	1½
One bathtub	2
One laundry tray	3
One combination fixture	3
One urinal	3
One shower bath	3
One floor drain	3
One slop sink	4
One water-closet	6

"One hundred and eighty square feet of roof or drained area in horizontal projection shall count as one fixture unit.

"**Soil and Waste Stacks:** Every building in which plumbing fixtures are installed shall have a soil or waste stack, or stacks, extending full size through the roof. Soil and waste stacks shall be as direct as possible and free from sharp angles and turns. The required size of a soil or waste stack shall be independently determined by the total fixture units of all fixtures connected to the stack in accordance with the following tables:

Waste Stacks

Number Fixture Units	Diameter of Stack Inches	Permitted Length Feet
1	1¼	45
2 to 8	1½	60
9 to 18	2	75
19 to 36	2½	105

Soil and Waste Stacks

Number Fixture Units	Number Water-closets or equivalent	Diameter of Stack Inches	Maximum permitted length Feet
37 to 72	1 to 12	3	150
73 to 300	13 to 50	4	225
301 to 720	51 to 120	5	300
721 to 1,080	121 to 180	6	400
1,081 to 1,920	181 to 320	8	600

"**Restrictions:** No water-closet shall discharge into a stack less than 3 inches in diameter. Not more than three water-closets or their equivalent in fixture units shall discharge into a 3-inch stack from one 3-inch branch, and not more than two such branches may connect to a 3-inch stack at the same point or level.

"**Vents, Required Sizes:** The required size of main vents or vent stacks shall be determined on the basis of the size of the soil or waste stack, the number of fixtures or fixture units connected to the soil or waste stack, and the developed length of the main vent stack in accordance with the following tables:

Waste Stack

Diameter of Stack (Inches)	Fixture Units on Stack	Dimensions of Vent: Diameter Inches	Maximum Length Feet
1¼	1	1¼	45
1½	2- 8	1¼	35
1½	2- 8	1½	50
2	9-18	1¼	30
2	9-18	1½	60
2	9-18	2	75
2½	19-36	1¼	25
2½	19-36	1½	45
2½	19-36	2	60
2½	19-36	2½	105

Soil or Waste Stack

Diam. of stack (Inches)	Fixture units on stack	Water-closets only	Dimensions of vent. Diameter Inches	Maximum length Feet
3	6- 18	1- 3	1½	20
3	6- 18	1- 3	2	60
3	19- 42	4- 7	2	45
3	19- 42	4- 7	2½	150*
3	43- 72	8- 12	2	30
3	43- 72	8- 12	2½	90
3	43- 72	8- 12	3	150
4	24- 42	4- 7	2	20
4	24- 42	4- 7	2½	45
4	24- 42	4- 7	3	100
4	43- 72	8- 12	2½	30
4	43- 72	8- 12	3	75
4	43- 72	8- 12	3½	150
4	43- 72	8- 12	4	300
4	73- 150	12- 25	3	60
4	73- 150	13- 25	3½	120
4	73- 150	13- 25	4	225
4	151- 300	26- 50	3	20
4	151- 300	26- 50	3½	50
4	151- 300	26- 50	4	100
4	151- 300	26- 50	5	225*
5	301- 480	51- 80	2½	20
5	301- 480	51- 80	3	50
5	301- 480	51- 80	3½	100
5	301- 480	51- 80	4	175
5	301- 480	51- 80	5	300*
5	481- 720	81-120	3½	25
5	481- 720	81-120	4	50
5	481- 720	81-120	5	125
5	481- 720	81-120	6	300*
6	721- 840	121-140	3	20
6	721- 840	121-140	3½	40
6	721- 840	121-140	4	75
6	721- 840	121-140	5	225
6	721- 840	121-140	6	400*
6	841-1,080	141-180	4	50
6	841-1,080	141-180	5	125
6	841-1,080	141-180	6	300
6	841-1,080	141-180	8	400*
8	1,081-1,920	181-320	4	20
8	1,081-1,920	181-320	5	60
8	1,081-1,920	181-320	6	150
8	1,081-1,920	181-320	8	600*

* Limit in height of soil stack but not in length of vent if greater is required.

NOTE:—The capacities and vent stack requirements for 4, 5, 6, and 8 inch soil stacks are extrapolated from data obtained for 2 and 3 inch stacks with liberal added factors of safety to provide for all necessary elbows or changes in direction in the vent stack. They are believed to represent safe installations and closer approximations to actual requirements than any tables now available.

"**Branch and Individual Vents:** No vents shall be less than 1¼ inches in diameter. For 1¼ and 1½ inch wastes the vent shall be of the same diameter as the waste pipe, and in no case shall a branch or main vent have a diameter less than one-half that of the soil or waste pipe served, and in no case shall the length of a branch vent of given diameter exceed the maximum length permitted for the main vent serving the same size soil or vent stack."

NOTE.—See article on Plumbing Design in Tall Buildings, Page 517, 1922 Year Book.

Study of the reference to a full size cross connection between soil or waste line and vent is well worth while in connection with the above tables.

Good practice would not permit the installation of a vertical waste carrier two to four hundred feet long without a break in it. At the angle fitting in such a break a full size connection between soil or waste line and vent should be made as suggested in the 1922 Year Book.

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THE MANUFACTURE OF VARNISHES, STAINS AND FILLERS

By R. W. LINDSAY, CHEMIST

Only a few decades ago varnish making bordered on an occult art. The formulas and rule-of-thumb methods used by different manufacturers were so zealously guarded that the interest of others did not reach back of the finished product. Then the chemist entered the field. He made an exhaustive study of the properties given to varnish and its allied products by the different materials entering into their manufacture. Thus equipped, he was able to make products exactly adapted to all of the increasing number of purposes for which finishing materials are used. This means that to-day the architect can find excellent materials for any finish that he may wish to secure; but this bewildering variety of materials also means that he must give more thought than ever before to his selection. Should I specify an acid stain or an oil stain? Why should I use varnish instead of shellac on floors? These are samples of the hundreds of questions that can be answered intelligently only when the solution is based upon a comprehensive, organized knowledge of the materials available. And for the one who will delve deeply enough, it is a study as fascinating as it is profitable.

In considering the above subject it will be necessary to divide this treatise into four distinct classes in accordance with the title.

Stains.

The subject of stains may be divided into four parts, as follows:

1st.....Aniline Oil Stains
2nd.....Aniline Spirit Stains
3rd.....Pigment Oil Stains
4th.....Acid Stains

By the aniline oil stain is meant a stain made by the solution of an aniline color in some solvent such as benzol, solvent naptha, turpentine, benzine, or in other words, an oil solvent. Often in combination with these aniline colors is used a considerable amount of asphaltum varnish in order to obtain certain desired results. There has always been, and still is, a great deal of doubt in the minds of most users as to just what is meant by an aniline color and when we consider the great number of organic compounds known as aniline colors, it is not strange that such is the case. By an aniline color we mean one derived from the chemical compound aniline which is found in coal tar. Aniline is then treated with various acids and other chemicals and we are able to form new compounds and from these compounds still other compounds, and it is these various new compounds which are formed that are the aniline colors of commerce. These colors vary in their solubility according to their composition and consequently we have aniline colors soluble in oil, aniline colors soluble in alcohol, aniline colors soluble in water and in addition we have also many aniline colors, which we may say are "forced" in their solubility, i. e., the aniline color may be only slightly soluble in a solvent such as benzol, but when combined with a fatty substance such as stearic or oleic acid, which is soluble in benzol, is carried into solution in this way. This latter fact accounts as you may readily understand for the non-drying nature of many of the oil anilines. The aniline color itself may be a material which would be perfectly dry, but of course, is not permitted to become so on account of the presence of these non-drying fatty acids.

The aniline oil stains have very strong penetrating powers and carry the dye far into the wood. They may be used on both hard and soft woods, both open and closed grains, but naturally better penetration is secured in the softer woods. These stains, being perfectly clear and containing no pigment, produce a beautiful, clear, transparent stain, usually rich in color and beautiful to look upon. This beauty is of course brought out by the application of shellac and varnish.

In finishing a panel with a stain of this nature we find that the stain works very easily, giving a remarkably uniform effect and apparently is an excellent product. Shellac is then applied and later the varnish and the brilliancy of the stain is very much enhanced. Supposing that we have a panel finished up in this way and the same is allowed to be set aside for some time and then later examined, we are very much surprised to find that, first, instead of having a stain rich in color that a great deal of its depth has disappeared and left in many cases, a muddy effect. At any rate the stain has faded very considerably. Secondly we notice that the varnish itself has died down very materially and that upon scratching the varnish film, we have instead of a firm, tough finish, a finish which looks very much as though it were made entirely of rosin. This latter effect is due entirely to what is termed "Bleeding" of the stain due to the following conditions: The stain as applied, was, as stated above, composed of aniline colors soluble in benzol, turpentine and other solvents of a similar nature, and consequently upon application of the shellac over the stain, the alcohol penetrated into the pores and dissolved out a certain part of the stain and carried it into its own film. The varnish, then following, also having the power by means of its thinner, to dissolve this dye, picks up the color and carries it into its own film. These colors are extremely susceptible to this kind of an action and have been known to have carried sometimes through five or six coats of paint. There is one case, which has come to my attention, where there has been applied over a finish of this kind two coats of varnish and five coats of white enamel, yet after each successive coat of enamel has dried, the pinkish cast of the mahogany aniline stain has appeared and cannot be removed unless the entire finish down to the wood is taken off and the color itself removed. Naturally the layman in having his house finished and noticing the condition of his wood finish from time to time, detects the failing of the lustre of his varnish and immediately draws the conclusion that the varnish applied to his house is of an inferior quality and it is my presumption that the reputation of the varnish manufacturer has been harmed a great deal more than we realize by such conditions. Of course, many of the manufacturers of stains of this nature do produce what are called primers, which are supposed to take care of this "Bleeding" effect and no doubt these articles do retard the "Bleeding" very considerably, yet there are none which are absolutely free from this trouble.

In this same class of materials of a somewhat different construction, are the **spirit stains.** These, of course, are made by a solution of aniline colors in alcohol and only used to a very limited extent on account of the fact that they are extremely hard to work and apply evenly, it being almost impossible to apply a stain of this character on a large surface with any degree of even-

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ness, and secondly, they are prone to work up into the shellac applied over them, so that it is almost an impossibility to get a good finish. They naturally "bleed" very considerably and have caused all kinds of trouble not only in this respect, but also in regard to their fading. Being used in such limited quantities as they are, it is not necessary to describe them further, but merely to state that they should be avoided.

The third type of stain mentioned above is what is termed **pigment stains,** and by such is meant one made by grinding of a pigment or pigments in oil, usually linseed oil, and its subsequent reduction with turpentine or some such vehicle sufficient to effect penetration. The pigments used in stains of this kind are:

Ochres
Siennas
Ambers
Chrome Yellows
Chrome Greens
Carbon Black
Prussian Blue
Para Reds, etc.

and as you can readily see, their staining effects must be really due to the lodgment of the pigment within the pores of the wood. In reality they are nothing but a thin paint sufficiently reduced so as to penetrate the pores of the wood. These stains do not give as clear an effect as the penetrating stains nor do they penetrate the wood so readily, and consequently are limited almost entirely to soft woods where a sufficiently deep penetration may be effected. However, even though these stains are not quite as clear as the previously discussed class of stains, yet they are sufficiently clear to produce some very beautiful effects and when we consider the fact that they are practically non-fading, have absolutely no tendency to "bleed" and that the after results are consequently very much more satisfactory than otherwise, we must concede that they are far superior to any stain in which the after-results are very questionable. Furthermore, these stains being made upon a linseed oil base, have a tendency to preserve the wood and consequently are of material assistance in this way.

The third class of stains mentioned above are the **acid stains.** The term acid, applied to most of these stains is a misnomer on account of the fact that nearly all of these stains of this class are practically neutral in their reactions, i. e., they are not made by the solution of acids in water as the same suggests but are made by the solution of various dyes in water or a medium miscible with water. These stains are perfectly clear solutions and when applied to the work, they work very easily under the brush and may be spread out over large areas with a degree of evenness. Having been applied, and the work finished, they are very permanent as regards fading and have little tendency to "bleed".

The reason for the latter effect is due to the fact that the dye used is a water soluble product and consequently even though the vehicle of the varnish applied over the stain may penetrate into the wood, yet the dye is not picked up and consequently does not "bleed" into the successive coats of varnish. This point may be very readily illustrated by carrying out the following experiment: A panel, for example, is finished at one end with coat of mahogany aniline oil stain and at the other with a coat of mahogany acid stain and a coat of shellac is applied over the entire panel, followed by a coat of white enamel. Allow this panel to stand for a short time and the result is, that within a very short period of time, it will be noticed that the enamel over the aniline oil stain is covered with reddish spots, showing the way in which the "bleeding" has taken place. The enamel over the acid stain has not been affected, thus indicating the "non-bleeding" nature of this stain. These acid stains produce beautiful, clear, transparent effects, are permanent and "non-bleeding" and are really the ideal kind of stain, but like many other materials which are so nearly perfect, they have one defect. This defect is due to the fact that when the water is applied to wood, the grain is caused to raise very materially and it is the sanding down of this grain, which restricts somewhat the use of the acid stain. The acid stain is confined almost entirely to the use of hard woods on account of the fact that the softer woods necessitate a large amount of sanding. The best practice is, of course, to sponge off the wood first, sand and then apply the stain and follow with another light sanding. In this way, the maximum amount of stain is retained in the wood and the effect is not spoiled. Notwithstanding this defect, however, these stains are really the most practical, most lasting and produce the most satisfactory results.

FILLERS.

This class of materials may be divided into two parts:

Liquid Fillers.

Paste Fillers.

When Liquid Fillers were first placed on the market, they were offered as substitutes for shellac and at that time the material sold as such was of far better quality than most of the so called Liquid Fillers of today. Today, most of these goods are composed of nothing more than Gloss Oil, a little Linseed Oil and the cheapest Pigment it is possible to get. All kinds of pigments have been used but the most satisfactory are either asbestine or China Clay on account of the property these pigments have of remaining in suspension. Notwithstanding the fact however, that the general run of Liquid Fillers has deteriorated so much, a few of the best manufacturers are producing goods for this purpose which really have quality. These goods are necessarily made so that they dry very hard and firm, carry sufficient pigment so as to fill the pores to a certain extent and give a surface which is very non-absorbent and over which the varnish may be applied in such a way as to have a good full body and lustre. This class of materials is not recommended for use upon floors or for exterior purposes on acount of its extremely hard nature, yet for certain purposes, it serves in a very favorable way, and may be recommended.

The second type of filler is the PASTE FILLER and by this product we mean one sold in paste form and made by mixing or grinding together of certain pigments, linseed oil and a japan drier. The function of a paste wood filler is to close all the pores of the more or less open grained woods, so that, while the surface becomes non-absorbent, the natural beauty is not obscured, and if the wood is stained, the filler must not dull the transparency of the stain. Therefore, the more translucent the filling material, the more valuable the product. Consequently, while barytes, clay whiting and gypsum are still employed on account of their cheapness, the ideal material for a filler is silex or silica. Silex or silica is really powdered quartz, and is a pigment which is extremely transparent, has considerable "tooth," and consequently makes an ideal pigment for this purpose. A paste filler is generally made by merely mixing the silica and its vehicle, and is received by the consumer in paste form. This is reduced with turpentine, and is then ready for application. A good filler should be dry in twenty-four hours, and then sanded and dusted off, leaving a surface ready for the application of the material following.

Fillers are really materials to which suf-

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ficient attention has not been given, and it behooves the architect to see that he gets the most translucent fillers possible even though the same costs him a little more, this extra expense being do doubt explained very largely by the fact that the pigment used is more expensive. Furthermore, the best grade of fillers always contain a good grade of linseed oil and a good gum Japan, the latter serving to harden up and to make the filler non-absorbent. Here, again, the use of a cheap filler necessarily means the use of a material containing a cheap japan which will have the effect of reducing the durability and stability of the filler. Colored fillers for various modern effects are, of course, made up by incorporating certain colors with the regular paste filler and some very beautiful results may be obtained.

VARNISHES.

This subject should be divided into two parts, as follows:

Spirit Varnishes.
Oil Varnishes.

After the wood has been properly filled, it is customary, both in architectural and industrial work, to apply a coat of spirit varnish. For many years practically no material was used for this purpose but shellac.

Gum shellac, as you are no doubt aware, comes to us very largely from India and is a resin produced by the vite or sting of certain insects on the small twigs of several species of East Indian trees. The resin appears to be formed from the plant sap by the female insect from whose body it exudes, ultimately burying the insect and her eggs and forming a thick excrescence on the twigs. This is collected, macerated with warm water to extract a dye and the residue (Seed Lac) is refined by melting and straining. It is then poured in thin films on wooden cylinders when it hardens and scales off in thin flakes and is then called "shellac."

Bleached shellac is made by passing a stream of chlorine gas into an alkaline solution of shellac. There are on the market a number of grades of shellac, due to the fact that during the melting process, rosin is added to facilitate the melting process. The result is that we have a great many products termed shellac which contain a very large proportion of rosin and many which contain absolutely no gum shellac.

Due to the extremely high cost of shellac there has come upon the market a large number of shellac substitutes and, as with all other varnishes, there are many which can be used with a high degree of satisfaction and many which are absolutely worthless. Most of the better grades of shellac are made by dissolving certain spirit copal gums in alcohol. On the other hand, there are a large number of shellac substitutes which are made on a rosin base or at least contain a large proportion of rosin so as to make a substitute which is satisfactory only from the standpoint of price.

To my mind, one of the most important points in an architect's specification is the question of the character of the spirit varnish which is applied over the filler; for the reason that, just as no house can be built with a foundation of sand, so no finish should be built up with a foundation coat which has no durability, is extremely brittle and has in fact no qualities to recommend it except that of cheapness. An architect in recommending a manufacturer's grade of substitute shellac has, of course, the assurance of the house manufacturing that goods that it will be satisfactory. On the other hand, as an architect specifies "shellac" and does not definitely specify as to the grade of shellac, he cannot be certain as to the results. It might be well to suggest that if an architect desires that shellac be used, he write a specification like that of the Government which compels the use of a shellac containing no rosin nor other adulterants. With the extremely high cost of shellac at the present time, architects will find it well worth their time to consider shellac substitutes made by reputable manufacturers for work where it is not necessary to secure the very highest grade of finish.

We now come to the subject of Oil Varnishes, and in taking up this matter we will discuss the various materials used in varnish making and follow this with a brief description of the process itself.

Varnish has four main constituent parts.

First: The fossil resins, or gums, as they are termed, which give to the varnish its brilliancy and lustre and to a certain degree it durabilty.

Second: The drying oils which render the varnish elastic, durable and to a certain extent affect the lustre.

Third: The metallic driers which are incorporated with the oils to hasten the drying of the varnish film, acting as carriers of oxygen from the air to the drying oil.

Fourth: The volatile solvents which aid in the spreading of the varnish upon the work.

First we shall take up the various raw materials used in making varnish, and describe the source from which these various materials come, and then later, the way in which these materials are used in the actual varnish making process.

The first of the raw materials to be considered are the resins, which are divided into three classes. We first have the fossil resins, which are the exudation of trees which existed thousands of years ago, the sap having flowed from the trees to the ground where it was covered with decayed vegetation, etc., and fossilized. Second, we have the semi-fossil resins, which are the exudation of trees of more recent origin, and third, we have the crop resins, which are gathered directly from the tree, the tree being cut in such a way that the sap will flow and this sap is hardened by oxidation.

Zanzibar Animi is a fossil resin coming to us from Zanzibar on the eastern coast of Africa, and is characterized by the goose skin effect which we find upon the various pieces of gum. The gum is extremely hard, and was formerly used in the manufacture of our best grade of piano varnishes and interior varnishes. It was used in the piano varnishes on account of the fact that it makes an extremely hard varnish, and one which may be readily rubbed and polished. It was used in the spar varnishes on account of the fact that it made a varnish which was very durable. This resin is not used today on account of the fact that it is practically impossible for us to obtain sufficient quantities for use in a practical way.

The next resin is that of the Congo Copal, the term Copal being applied to the gum found upon the west coast of Africa, to differentiate between these and the ones found on the east coast of Africa, of which the Zanzibar is a type. The Congo Copal is very light in color, makes a varnish which dries with a good hard film, and is used in large quantities in high grade varnishes. For this reason it is used in high grade baking varnishes and interior varnishes where color is an essential feature.

The Benguela Copal is very similar to Congo, coming from the same general district on the west coast of Africa, but differs in that the varnishes made from this gum are darker. The Benguela is characterized by the greenish cast which is displayed through out the various pieces of gum.

The Sierra Leone Copal is one of the most elastic resins known to the varnish maker. For this reason it has been used with wonderful success in the pale coach and car var-

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nishes and in spar varnishes, where elasticity is the most essential feature. At the same time it makes a varnish which has a very light color, and for this reason it is also very suitable for pale baking varnishes and also for varnishes where elasticity is a most important factor. This resin comes to us also from the west coast of Africa, coming from the district of Sierra Leone.

The next class of resins is the Kauri, coming to us from an entirely different region —from New Zealand. Kauri is one of the most popular resins in the varnish industry on account of the fact that by it may be made a most durable varnish, and also a varnish which is excellent for rubbing and polishing purposes, due to the fact that when this resin is handled properly varnish may be made which has less tendency to "sweat out" in the process of rubbing than a varnish made with other gums. Furthermore, Kauri has very good durability, and is consequently used in the high grade exterior varnishes. Kauri comes to us in various grades, ranging greatly in physical characteristics and price. The better quality Kauri, for instance, costs at the present time $.90 per pound. The No. 1 Kauri costs $.50 per pound, while the Brown Kauri costs $.15 per pound. The varnishes made with these various grades of Kauri have, of course, the same general properties, yet differ so considerably that it is most important that the grade of gum be considered very carefully in the manufacture of a varnish.

The Manila Copal is a type of the resins which are termed soft resins, and comes to us mostly through the port of Manila, being found largely in the East Indies. White Manila is used a great deal in the cheaper interior and medium priced varnish, and when handled properly some very good results can be obtained. However, it carries quite a large amount of free acid and has the property of causing a varnish to have a softer film than one made with the Kauri or the other harder gums. Manila, like Kauri, comes to us in various grades, the best being the White Manila and a cheaper grade being the Manila Nubs, which is a form very popular with the varnish manufacturers on account of the fact that the Manila Nubs, being small pieces, are much easier to handle than the White Manila, which comes in extremely large pieces. The Manila gum is derived from one of the most prolific gum-bearing trees known, and some of the pieces of gum which have been found are very large in size, being sometimes two or three feet in diameter.

The Damar resin is a gum which is probably very familiar, having been used for years in the manufacture of Damar varnish. Its one important feature is its color, and that is about all which we can say for it. It has no durability, is very soft, and a resin with a very low melting point, so that it cannot be used in any of our high grade varnishes. Damar resin has been used for a great many years for the manufacture of white enamels and for a considerable length of time all the white enamels on the market were made upon this base. Today, however, the highest grade of white enamels contain no Damar on account of the fact that it is lacking in durability. We still, however, have a great many cheaper, quicker drying, and less durable enamels, which are made upon a Damar base.

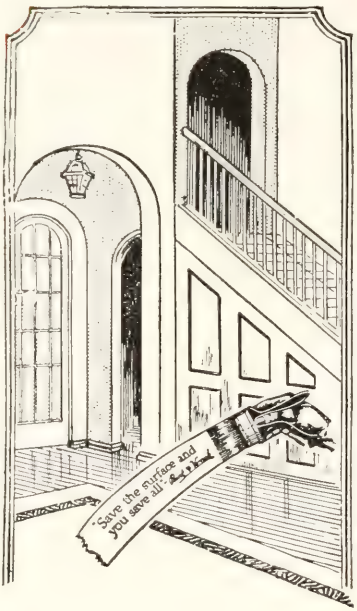
The Asphaltum is not really a resin, being a cross between soft coal and petroleum, and comes to us largely at the present time from Utah. This bituminous material is used in the manufacture of our black air drying and baking japans, being used largely upon iron work.

While the above does not describe all of the resins which are used by the varnishmaker, yet it gives an idea of the various properties which the varnishmaker obtains by using the different grades and kinds of resins, and we shall now proceed to give a brief description of the various ways in which these resins are gathered. As mentioned above, these resins are formed by a fossilization of the sap, which came from trees, which existed thousands of years ago, and it is of particular interest that many of these resins are found as deep in the earth as twenty or more feet.

The gum digging industry in the early days, particularly in New Zealand, was for many years carried on in a desultory manner, with the result that practically no gum was procured except that which lay on the surface. The gum diggers in the olden days would start out in the morning with what they termed their prodding stick and knapsack on their backs and by the use of this stick would determine places where the gum could be found. They would proceed to dig up the gum and carry it with them until evening, when they would sit around their camp fires and scrape the gum and prepare it for the market. Today, however, the gum digger is more like our modern miner. He starts off with his various prospecting sticks, his spade and coarse tooth saw, with which he saws around the roots and moss in order to unearth the gum. The surface of the earth, is then dug up and the gum and dirt thrown to one side. This digging goes on until at times we find diggers have proceeded to a depth of twenty feet below the surface of the earth in their search of gum. The gum is then thrown upon a screen, where it is washed and the earth and other decayed matter separated from it. The gum is then all scraped and sorted, and then carried down to a general warehouse, where it is further sorted and graded. The gum is then taken to the brokers' warehouse where it is further sorted by men who have wide experience in this line. These men start as mere boys, first working on the cheaper gums and then they are gradually promoted to work on the higher grades of gum. This is very important work when we realize the variations in its price. The gum is then put into bins, and from the bins is packed in cases, then shipped to foreign ports.

We now pass on from the subject of gums to that of oils, and the first oil we shall mention is, of course, Linseed Oil, which is made from the flaxseed grown in Canada, United States, Argentine, India, and around the Baltic Sea, and it is very curious to note that the oil from these various parts of the world should differ so much, due probably to climatic conditions and also to methods of harvesting.

The flax is cut in the field and the flaxseed is then separated from the flax stalk. This seed, in the case of that grown in our own country, is then carried to the various lake ports and comes down the lakes in large grain boats. The seed is then conveyed from the boats to the grain elevator, and is separated according to the various grades and the source from which it comes; it is then carried by means of large conveyors to the rolls. These consist of large steel corrugated rolls between which the seeds pass until they are entirely crushed into the form of a fine powder. This powder is then emptied into the tempering kettle on the floor below, where a certain amount of moisture and heat is applied by means of steam, the proper amount of moisture and the correct temperature being judged by the workman, who is very expert at this particular trade, gauging the temperature and moisture by the feel of the seed in his hand. When the powdered flaxseed is in proper condition the seed passes out under the "former" between two camelhair mats. It is then placed in the presses, the mats being one above the other and when the



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press is entirely set up a large hydraulic ram forces the mats together, pressing out the oil from the seed.

The material left in the press is the linseed oil cake, and all the surplus oil is found at the edge of the cake. The cake is consequently passed through a trimming machine, which takes off this edge and the cake is then baled up ready for shipment and the trimmings are sent back to go through the process once again. This cake is used largely for a cattle food, and the largest portion of it is shipped abroad to Belgium and Holland.

The oil is then filtered by filter presses, passing through filter cloths, and is now ready to be filled into the barrels. Thus we have our raw linseed oil. The oil at this point, however, is not in proper condition for use by the varnish maker on account of the fact that when heated to a temperature of about 450 degrees F., mucilaginous material, otherwise known as the "Break," separates from the oil. Consequently it is necessary that the linseed oil manufacturers further refine the oil, which is done by means of various chemicals and mechanical devices in order to produce an oil which will meet conditions imposed by their customers. At this point also the various driers are added to the oils in order to prepare the boiled oils found upon the market.

The next oil we shall consider is an oil which perhaps, is not quite so familiar as linseed oil, being our China Wood Oil, an oil made from the nuts of the Tung tree, a tree indigenous to China, growing largely in the interior of China, particularly along the banks of the Yangtse River. These trees bear fruit about the size of a small orange, each fruit containing five segments, each segment containing a kernel. The fruit is roasted over a fire, which breaks open the segments, the kernels separate and these kernels are then placed in the crushing machines.

The Chinese in the olden days used an extremely crude piece of apparatus for crushing these kernels, being nothing more or less than a large stone, which is rolled back and forth in a trough and crushes the kernels. A more modern crusher consists of a large stone weighing several tons; this is drawn around within the circular trough by means of mules, horses or other animals, and the kernels as they are crushed, gradually move toward the center. It is a very primitive means of carrying out these processes, but it must be remembered that individual Chinamen carry out the process on their own farms and therefore, the machinery cannot be very complex. The powdered China Wood Oil nuts are then tempered and placed between bamboo mats, and heated over a kettle of boiling water until the powdered nuts have picked up sufficient moisture and the mats are then placed edgewise in the large press. This press also is of primitive style, consisting of large mats, and a large wooden ram forces the logs between which the mats are set edgewise together, pressing out the oil. The oil is then filtered through bamboo cloths, and is then carried down to the China Wood Oil broker in large baskets, the baskets being lined with a peculiarly oiled paper. Each Chinaman carries four baskets, two being suspended from two sticks swung across the shoulders; each basket of oil which is purchased is tested and its richness determined. The oil is then emptied into the tanks, and from these tanks is drawn off into the barrels, in which it is shipped to varnish manufacturers. China Wood Oil being very different from linseed oil, and in fact, from any of the other oils, we will mention three of its chief characteristic properties. China Wood Oil when allowed to dry by itself on glass, instead of drying with a clear, transparent film as does linseed oil, dries with a cloudy opaque film, very much resembling a piece of ground glass. Secondly, China Wood Oil when heated at a temperature of about 450 degrees F., instead of gradually thickening as does linseed oil, it almost instantly goes over to a solid jelly very much resembling soft rubber. Thirdly, China Wood oil when placed in a bottle and exposed to the light, even though the bottle is air-tight, will, by the actinic rays of the sun be converted to a lard like mass. This last property is very easily overcome by the heating of the oil. The gelatinizing of the oil is also very easily taken care of by proper treatment with various gums, etc. However, the most difficult feature to overcome is that of the "dry-flat," as the varnish maker terms it. This is due to a wrinkling of the varnish film, and I would add it has cost the varnish manufacturer a great deal of money, and they have spent a great deal of time in order to overcome this very serious drawback. However, after years of study the larger manufacturers understand this property thoroughly and have overcome it entirely.

You may ask with all these drawbacks, why it is that the varnish maker should care to use China Wood Oil at all. In the first place, China Wood oil has two important properties which are not found in linseed oil. A varnish made with China Wood Oil will be very much more waterproof than that made with Linseed Oil. In the second place, China Wood Oil has the property of causing the varnish to harden very much quicker than when Linseed Oil is used. These two properties make China Wood Oil a very important and essential feature in certain classes of varnishes. On the other hand Linseed Oil produces in a varnish greater elasticity fuller body and lustre, better flowing properties than can be obtained with China Wood Oil. In producing a varnish, it can readily be seen that it is necessary to utilize each of these oils according to the results desired in the varnish. If, for instance, we desire to produce a spar varnish which must needs have a maximum amount of elasticity in order to stand expansion and contraction due to weather conditions, it is necessary for us to use the most elastic materials which we can possibly obtain, consequently Linseed Oil gives us for this purpose the best results. China Wood Oil, on the other hand, when used in a spar varnish attains its waterproof qualities very much quicker upon exposure, will retain a perfect film only for a short period of time after which the film deadens, cracks and makes an extremely poor surface for refinishing. The Linseed Oil varnish on the other hand while it dries and hardens more slowly and possibly, if rained upon, before it has hardened, will turn white (this whiteness disappearing upon its drying out) yet, at the end of about six months, the film will have worn evenly, and the varnish will have retained a good portion of its lustre.

If we now desire to produce a floor varnish, we must bear in mind that the necessary requisites of a varnish of this kind are that it must be very tough, elastic, waterproof and hard drying. This last property meaning that it must not soften up in warm, humid weather. In designing a floor varnish, we must of course look to the China Wood Oil for our waterproofness and, to a considerable degree, our hard drying properties. At the same time, we must look to our Linseed Oil in order to obtain the maximum amount of elasticity in the varnish film. This latter property is one, which is extremely important and which really determines whether or not a varnish will wear down evenly or whether it will crack and chip. Most people do not realize the amount of stress caused by the impression of heels

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on a varnished floor, but upon considering this point, you can readily understand that it is necessary to have the maximum amount of elasticity in order to obtain the very best results. Thus, you can realize that in making a varnish for a definite purpose it is necessary to use those properties found in each of these oils in order to obtain a properly balanced product, and this only serves to emphasize the importance of specifying for definite kinds of work the varnish which has been especially designed for that purpose.

We will next take up the subject of Turpentine which is made from the sap, that comes from our southern pine trees. These trees were formerly cut according to the "Box Method;" that is, a box was dug at the base of the tree and the bark then cut from its side. The sap flowed down the side of the tree, ran into the box and was emptied from the box into a basket, then into barrels in which it was carried to the still. Today, however, on account of the fact that this method shortens the life of the tree, undermines its resistance to storms and thus permits great losses, we have perfected what is known as the "Cup and Gutter System." That is, the sap runs down the side of the tree into a gutter and then from the gutter into the cup, thus the tree is not wounded except on its side, and it is found that the production of sap is greatly increased as well as its quality improved. Furthermore, the trees last a great deal longer and there is not the danger of the entire destruction of forests by wind storm. The sap after being gathered from the tree is then taken to the still, where, a small amount of moisture having been added, it is heated in a large copper retort; the turpentine passes over as a vapor, through coils, is condensed and we have our gum spirits of turpentine. The residue left in the retort is rosin, which is subsequently strained, cooled and prepared for the market.

The material which I have just described is known to the trade as Gum Spirits of Turpentine and it may be well to mention the difference between this product and Wood Turpentine. Gum Spirits of Turpentine is, as I have described, made by the distillation of the sap of the pine tree, whereas, Wood Turpentine is made by the distillation of the wood itself usually utilizing for this purpose, the stumps of pine trees which have fallen. Both of these products are very similar in chemical constitution and in many cases can only be distinguished by their odor. It may be of interest to know that the American Society for Testing Materials in drawing up their specifications for turpentine have adopted a specification to which a high grade of Wood Turpentine can conform based upon the fact that the latter when conforming to this specification is equal in every way to the Gum Spirits. It is important, however, in permitting the use of Wood Turpentine to insist that it conform to such specifications as these, as there are upon the market many grades which have entirely different properties and which should, under no circumstances, be used.

Having discussed the various raw materials used in varnish making, we will now describe briefly the varnish making process.

The gum or resins usually in approximately one hundred-pound lots are placed in a copper kettle, which stands about three feet high and about two and one-half feet in diameter. The kettle is then rolled upon the fire, the gum melted and held there until a certain proportion of the gum has been distilled off. At this endpoint, which is determined by the varnish maker, the melt is drawn from the fire and the oil, which has been heating at an adjacent chimney and which had been previously prepared, is emptied into the kettle. The gum and oil are then thoroughly stirred together, the kettle being run back on the fire and the gum and oil heated until thoroughly amalgamated. This endpoint is also determined by the varnish maker, who has his own particular way of judging as to when the melt is finished and when the batch is completed. The kettle is then withdrawn from the fire and allowed to cool, when it is taken to the thinning room, where the turpentine or other thinners are added. The varnish is then pumped into coolers, where it is allowed to cool to a certain extent before passing to the filter presses, which take out all the dirt. This is done very carefully, in order to take out the most minute particles of dirt and the varnish is then pumped to the ageing tanks, where it is allowed to age for a certain period of time, according to the quality of the varnish.

The question of ageing a varnish is one which has been given a great deal of study, and it has been proven that the ageing of varnish does improve it very considerably, both as regards its brilliancy and durability. This is apparently due to the fact that the various constituents of the varnish gradually become more and more closely knit together, which results in the improvement of the varnish.

While the matter of ageing is one, which has, in many cases, been very much overdrawn, yet, at the same time all manufacturers of the highest grade varnishes, even at the cost of tying up their capital, deem it sufficiently important to age their varnishes from one month to twelve months according to the character, grade and composition of the varnish. The completion of the ageing process is determined by tests made upon the varnish itself. After the varnish has been properly aged, it is then pumped to the filling tanks, from which it is drawn into the can or package, which is then labelled, and we have our finished product ready for the market.

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STANDARD PAINTERS' MATERIALS.

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Classification of preservative and decorative coverings is commonly made according to the nature of the surfaces which these materials are designed to cover.

Materials for painters' work are divided according to their nature under the following headings: Pigments, Binders and Agents or Solvents.

Paint consists of a binder or binders and a pigment or pigments incorporated or mixed together. Mixing of paint ingredients is accomplished in a manner either by stirring or grinding together by hand or by machinery. Machinery mixing with proper apparatus is most certain to secure uniformity of result, and is therefore advised where practical. It is practically impossible to get a perfectly smooth paint by hand mixing.

Linseed Oil is the only known universally successful binder for paint and the holding power of the paint depends almost entirely on the strength of the linseed oil used. This oil is adulterated in many ways, but the most common is with mineral oil. The manufacturers of mineral oil substitute have perfected their product to such an extent that it is difficult to distinguish it from the real article except by chemical test or actual use, when its inferiority is quickly manifest.

STANDARD BINDERS.

Raw Linseed Oil is the oil obtained from seeds of the Flax-plant, Linum Usitatissimum, and what is known as commercially, pure grade, has a specific gravity of not less than .932 nor in excess of .936, when the temperature is 15½° Centigrade, or at temperature 25° Centigrade, not less than .927 or more than .931. It has a minimum Acid number 6, Saponification number minimum 189, maximum 195. Unsaponifiable matter maximum 1.50%. Refractive index at 25° Centigrade minimum 1.4790 to maximum 1.4805, Iodine number (Hanus) 170 It is a straw yellow in color, weighs approximately 7½ lbs. to the gallon.

Boiled Linseed Oil, commercially pure, consists of raw linseed oil as above defined, kettle boiled at a temperature not to exceed 500 deg. Fah. nor less than 300 deg. Fah.; or the same sort of oil prepared with best pure Japan dryers, so as to increase drying qualites. If salts of lead or manganese are thoroughly incorporated into the raw oil, very similar results are produced to the boiling process. An old method of increasing the drying properties of linseed oil was to heat the oil to near the temperature at which it undergoes destructive distillation (550 deg. Fah. or thereabouts), and stir in at the same time, oxide of lead or oxide of manganese, or both. Such method, however, darkens the oil very much.

The U. S. Army Standard Specification for Boiled Linseed Oil Is as Follows:

Specification W. D. 2.

It shall be absolutely pure, well-settled linseed oil boiled with oxides of manganese and lead. It shall conform to the following requirements:

	Max.	Min.
Specific grav. at 15.5°/15.5°C.	0.945	0.937
Acid number	8.000	....
Saponification number	195.000	189.000
Unsaponifiable matter, pct.	1.500	....
Refractive index at 25° C.	1.484	1.479
Iodine number (Hanus)	....	168.000
Ash, per cent.	0.700	0.200
Manganese, per cent.	....	0.03
Lead, per cent.	....	0.1

STANDARD SOLVENTS.

Spirits of Turpentine, chemically pure, is composed of a volatile oil obtained by the distillation of turpentine oil obtained by tapping or boxing yellow pine trees. It is a clear, colorless liquid, with a pleasant, pungent odor and shows a very slight residue when evaporated. Spread over any surface in a thin layer, it will dry in twenty-four hours, leaving practically no residue. Turpentine weighs about 7 lbs. to the gallon of bulk.

The U. S. Army Standard Specification for Turpentine Is as Follows:

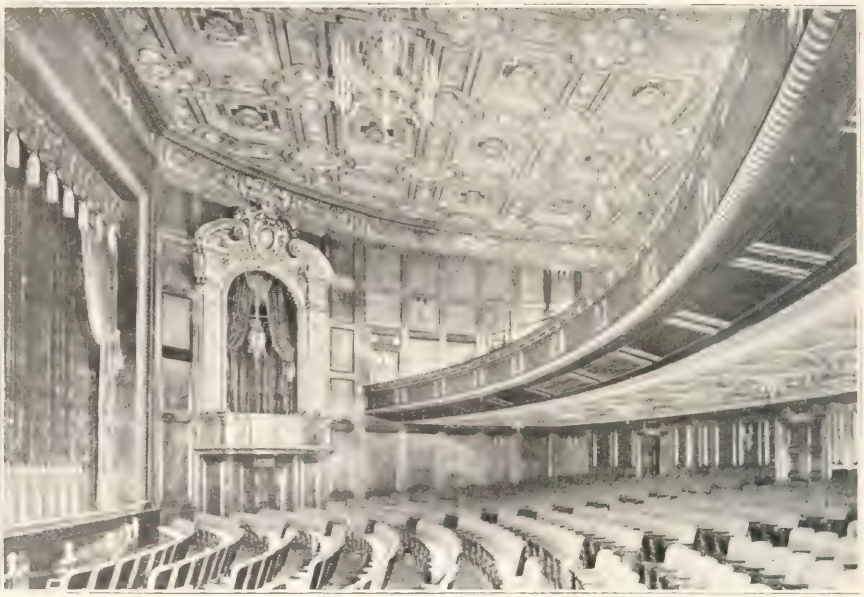
Specification W. D. 3.

This specification applies both to the turpentine that is distilled from pine oleoresins, and commonly known as gum turpentine or spirits turpentine, and to the turpentine commonly known as wood turpentine that is obtained from resinous wood, whether by extraction with volatile solvents, by steam, or by destructive distillation. The bidder should state whether gum spirits or wood turpentine is furnished.

The turpentine shall be clear and free from suspended matter and water. The color shall be water white. The specific gravity shall not be less than 0.860 or more than 0.875 at 15.5° C. The refractive index shall not be less than 1.468 or more than 1.478 at 15.5° C. The initial boiling point shall be not less than 150° C. nor more than 160° C. Ninety per cent of the turpentine shall distill below 170° C. The polymerization residue shall not exceed 2 per cent and its refractive index at 15.5° C. shall not be less than 1.500.

STANDARD PIGMENTS.

Red Lead, practically pure from a commercial standpoint, is equal to 98 per cent lead tetroxide; but to secure this degree of purity, without a trace of soda or nitrate salts, requires a special method of reduction not employed by all manufacturers. In fact it has only been within the last few years that even the best manufacturers have been able to produce a pure red lead without having present from .1 to .5 per cent of soda or nitrate salts, which salts have a strong tendency to promote rust. Paint is intended as a protection of metal against rust, and as such should not contain any elements of a rust inducing nature. Specification should therefore require that red lead must be wholly free from soda or nitrate salts. The process now used to get red lead which is 98 per cent true, is by burning the lower grade red lead, 85 per cent true, for about 20 to 24 hours longer. This brings the true red lead, $Pb_3 O_4$ up to the high standard which has lately been accepted as most effective in preventing rust. The American Society of Testing materials after exhaustive tests conducted within the last nine years have concluded



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that the highest grade red lead, 98 per cent true, is even more lasting in character than the red lead which was formerly considered best for paint pigment which was about 83 per cent true red lead Pb_3O_4 (tetroxide of lead) plus 17% litharge PbO (mon oxide of lead). The Government specifications have been raised from 85 per cent to 90 per cent true, and lately have been increased to 95 per cent of true red lead. (This observation does not apply to the war department which still follows the old standard).

This, therefore, argues very strongly for the 98 per cent true red lead, but it still remains a fact that very enduring paint can be made in compliance with the following formula: Pb_3O_4 (tetroxide of lead), 85 per cent plus litharge PbO (monoxide of lead) 15 per cent. Owing to the tendency of this combination of red lead and litharge pigment to unite with linseed oil in chemical combination, paint composed of red lead and linseed oil should not be prepared to exceed twenty-four hours before using. For if this combination of red lead and litharge is mixed with linseed oil and sealed up in an air-tight can, it will be found after a time that the mixture has solidified showing that the oxygen of the air which is the hardening agent in ordinary paints is not necessary. The chemical combination that thus takes place between the litharge and the oil in this mixture probably gives an increased toughness and endurance to paint applied according to this formula, provided this chemical action takes place after the paint is applied. Practically, it is very difficult to secure intelligence in the application of paint to structural portions of a building and it is therefore doubtful practice to use so large a percentage of litharge, not because it will not make a strong enduring paint, but because it is extremely difficult to get same applied before chemical action takes place. It has been found also that the addition of say 10 per cent of a practically inert pigment such as Princess mineral or oxide of zinc, increases the wearing quality of red-lead paint without other injurious effect.

The U. S. Army Standard Specification for Reinforced Red Lead Paint Is as Follows:

Specification W. D. 40.

Pigment 64 per cent.
Liquid 36 per cent.

The pigment portion shall consist of Red Lead (not less than) 60 per cent, the balance to be Silicious Matter, such as Aluminum Silicate, Magnesium Silicate, Silica or a mixture thereof.

The Red Lead used shall contain not less than 85 per cent Pb_3O_4, the balance to be PbO.

The liquid portion shall consist of—

Pure Raw Linseed Oil (not less than) 90 per cent, the balance to be combined Drier and Thinner. The thinner shall be Turpentine.

Special Requirements: The paint must weigh not less than 16 pounds per gallon. It is intended to be used for a Priming Coat on Steel and when applied to smooth iron surface, it shall dry in 12 hours without running, streaking or sagging.

Corroded Lead, Basic Lead Carbonate chemically to $PbCO_3Pb(OH)_2$ is the form of lead pigment which has been in most general use for many years past. A satisfactory formula for white lead pigment is 70 per cent to 75 per cent of lead carbonate to 25 to 30 per cent of lead hydrate; this is in substantial compliance with U. S. Government standard specifications. While Basic Lead Carbonate is more poisonous than sublimed lead it still is a perfectly safe pigment to use with proper precautions. In fact nearly all paint pigments are more or less poisonous and so care should be taken by painter to avoid allowing paint to come in contact with the skin.

Sublimed Lead or Basic Lead Sulphate= chemically to $PbSO_4PbO$ is coming into general use for paints and is practically non-poisonous and is just as valuable as a pigment for many purposes as the older form. It is particularly satisfactory as a base for tinting colors.

The U. S. Army Standard Specification for White Lead Basic Sulphate Is as Follows:

Specification W. D. 49.

The dry pigment shall be of the best quality, amorphous in structure, and of great opacity.

It shall contain:

Not more than 0.5 per cent Moisture,

Not more than 8.5 per cent Zinc Oxide (ZnO).

Not more than .075 per cent Sulphur Dioxide (SO_2), and

Not less than 12. per cent Lead Oxide (PbO).

Unless otherwise specified, this Basic Sulphate-White Lead shall be delivered in paste form, finely ground in pure, clear Raw or Refined Linseed Oil in the proportion of:

90 pounds Pigment.

10 pounds Oil.

White Lead Paste averages to contain by weight 92 per cent dry lead pigment and 8 per cent linseed oil and weighs about 38.1206 ibs. to the gallon of bulk.

Zinc White is oxide of zinc made by burning zinc in air. It is whiter than White lead but is not so opaque, and more coats of zinc paint are necessary to get a given effect over a dark background than of white lead. Paint consisting of commercially pure zinc white and linseed oil makes a strong and enduring wearing surface but does not produce as satisfactory ground for repainting after a period of service, as paint composed of a white lead pigment and linseed oil.

Combination Paint composed of an admixture of right proportions of White Lead and Zinc White with Linseed Oil will undoubtedly give better service than either White Lead and Oil or Zinc White and Oil alone, possibly for the same reason that two or more sizes of aggregate rightly proportioned make a better concrete with a lesser amount of cement than aggregate of only one size.

Graphite, or plumbago, may be said to be diamond plus heat; for if a diamond is heated to a very high temperature, without access to the air, it swells up and is converted into a black mass exactly resembling graphite in every particular. This theory being further verified by the fact that this change takes place without the loss or increase of weight. Graphite is found in nature in large quantities. It is sometimes found crystallized, but in a form different from diamond. Graphite can be prepared artificially by dissolving charcoal in molten iron; from such a solution graphite is deposited on cooling. Pure graphite is dark grayish-black in color and of a metallic luster. It is quite soft, leaving a leaden-gray mark on paper when drawn across same. It is used in the manufacture of the so-called lead pencil and is sometimes called black-lead. Such designation is wholly misleading, as it is in no sense metallic lead. Graphite is pure carbon, the element which is the principal constituent of all organic matter, both vegetable and animal. It is extensively used as a paint pigment, particularly for metal coating. Finely

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ground amorphous or non-crystallized graphite, when mixed with linseed oil, forms a perfectly inert pigment when united in mechanical mixture with the oil and without the slightest evidence of chemical combination. For this reason prepared graphite-paint is not injured by age as is the case with oil-paints, which are composed of oil and a pigment which will form a more or less stable chemical union with same. It is contended, by advocates of Graphite paint, that the inert nature of graphite pigment contributes to the ease of its application and adds to its covering capacity and elasticity, making a better appearing mechanical job with less labor and also a covering which can accommodate itself to the contraction and expansion of the material covered without serious injury to its efficacy as a protective covering. The non-active nature of graphite pigment makes it possible to coat surfaces with a much thinner coating than with the paint containing a pigment which acts chemically with its oil.

Lamp Black is a very finely divided form of charcoal produced by the deposit on cold surfaces of the imperfectly combusted products from burning oil. Lamp black may be said to be the soot produced by burning oil without sufficient oxygen present to form perfect combustion. This soot is largely made up of fine particles of carbon. Lamp black is used in the manufacture of ink and as a pigment for paint to be applied to metal. Many of the best contracting painters insist that lamp black ground and mixed with linseed oil forms the most enduring and attractive appearing paint for ornamental iron.

Paint for metal, first coat, should not be applied until after the surface is thoroughly cleaned free from dirt or grease, as such material keeps the coating from coming in contact with the metal, so that it cannot adhere to same. It might be supposed that grease would be absorbed by paint or varnish but this does not prove true in practice. To mix such materials would require their thorough agitation together. This is prevented in the application over dirty surfaces due to the fact that the grease is always mixed with and covered by an adherent film of dirt, which interferes with the action of the paint or varnish upon it; consequently making a loose film which will not permanently support the paint coating.

Colors are produced by mixing the various color pigments with the standard base pigments of lead or zinc.

The addition of Tinting Colors to White paint generally greatly increases the durability of the paint. The volume of base pigment needs to be reduced in proportion to the amount of color pigment added, so as to maintain the same relative relation of pigment to oil in the various coats as hereinafter prescribed. The scope of this article does not permit a discussion of the composition and merits of the numerous commercial color-pigments offered to the trade.

Chemical action between the pigments and oil in paint ordinarily does not occur, but there are exceptions. Sabin states that such action takes place with White Lead and Linseed Oil, "probably between the oil and the lead hydrate, which constitutes at least a quarter of the pigment." "This change is said to be due to resinification of the oil converting it into a sort of varnish." "Zinc Oxide (White Zinc) also acts on oil, but in a much less degree." "Paint consisting of White Lead and White Zinc mixed together in the proportions of two of lead to one of zinc is reputed to be superior to either alone. Zinc brushes more readily and is said to have a spreading capacity of 50 per cent greater than a straight lead and oil paint.

Paint Proportions and Covering Capacity.

Primer of Lead and Oil for new work should be proportioned by bulk, so as to contain 27 per cent of White Lead Paste, 62 per cent of Linseed Oil and 11 per cent of Turpentine.

Priming Lead and Oil will require 10.3 lbs. White Lead, .62 gal. Linseed Oil and .11 gal. Turpentine to make one gal. of paint.

One Gallon Lead and Oil Primer will average to properly cover about 2¾ squares of new wood work or 1¼ squares of common brick work.

One Square of New Wood Work requires to properly prime same with lead and oil 3¾ lbs. White Lead, .23 gal. Linseed Oil and .04 gal. Turpentine, or if common brick requires 8.24 lbs. White Lead, .5 gal. Linseed Oil and .088 gal. Turpentine.

Succeeding Coats of Lead and Oil Paint after primer should be apportioned by bulk so as to contain 30 per cent White Lead, 64 per cent Linseed Oil and 6 per cent of Turpentine.

Succeeding Coats of Lead and Oil Paint after priming will require 11.44 lbs. White Lead Paste, .64 gal. Linseed Oil and .06 gal. of Turpentine to the gal.

One Gallon Lead and Oil Succeeding Coater will average to properly cover, any coat, about 4½ squares of wood work after same has been primed, or 3 squares of common brick work, second coat. Third coat on brick work, one gal. will cover as much surface as on wood.

One Square of Any Oil Succeeding Coat on wood work after same has been primed will average to require to properly cover same 2.54 lbs. White Lead, .14 gal. Linseed Oil and .0133 gal. of Turpentine; or for 2nd coat on common brick work, 3.48 lbs. White Lead, .21 gal. Linseed Oil and .02 gal. of Turpentine. Third coat on brick work will require the same amount of paint to unit of surface as "Succeeding Coats" on wood.

Primer for metal of red lead to give satisfactory results can be made by mixing 23 lbs. of dry "red lead for painting metal" to 1 lb. of "zinc white," adding sufficient commercially pure "raw linseed oil" to make a gallon of the mixture, and thoroughly incorporating together. The mixing of the oil and pigment should only be as required at the work, never to exceed 24 hours before applying. The paint resulting will be rather stiff and requires thorough and careful brush work to make the surface elastic, and the material cover proper area. This paint should not be thinned by addition of evaporaent liquids as these have a tendency to produce destructive chemical action on the paint, effecting its permanency as a protective coating.

Succeeding coats on metal, after primer, can very satisfactorily be of white lead and oil or zinc paints as above described, or a combination of the two.

Primer for masonry surface which has a strong alkaline reaction, such as plastered walls, brick masonry and concrete, should consist of a solution of zinc sulphate crystals dissolved in water, in the proportion of 3 lbs. to the gallon, after which succeeding coats of paint as defined above for wood work may be applied with satisfactory results. Oil paint should never be applied direct to masonry. There are a number of proprietary mixtures that are prepared especially for this purpose and which give excellent results.

Cheap Practical Substitute Oil Paint for more or less temporary use is illustrated by

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the U. S. Government War Department "Exterior Cantonment Paint" Standard Specification, which is as follows:

"W. D. 19"

This Paint also to be furnished in white when required.

Pigment 64%.
Liquid 36%.

The pigment portion shall consist of—

White Lead (Basic Carbonate, Basic Sulphate, or a mixture thereof).....42%
Zinc Oxide 33%
Aluminum Silicate, Magnesium Silicate, or a mixture thereof, combined with the necessary pure tinting colors to produce the desired shade (a total of) 25%

The liquid portion shall consist of—

Pure Raw Linseed Oil.....20%
Menhaden Oil,* Soya Bean Oil,** or a mixture thereof.....40%

The balance to be combined Drier and Volatile Mineral Spirits.

Special Requirements: This paint shall weigh not less than 15 pounds per gallon, and shall dry within 12 hours, and leave a surface suitable to recoat in 36 hours.

The above name and standard specification applies wherever similar type of paint is to be used.

* The Menhaden Oil used in this paint shall be pure, refined, light in color, and not of objectionable odor. It shall have the following chemical constants:

Specific gravity.....92-.93
Iodine number, not less than..... 166
Saponification number, not less than 186
Acid number, not more than..... 8

**The Soya Bean Oil used in this paint shall be pure, light in color, and shall have the following chemical constants:

Specific gravity.....92-.93
Iodine number, not less than..... 130
Saponification number, not less than 180
Acid number, not more than..... 4

Flat Finish Interior Paint

The most satisfactory Flat Wall Paints are made with Lithopone as the principal ingredient in the pigment. Lithopone is a wonderful pigment for interior use. It has great hiding power and spreading capacity and when properly mixed with the right kind of liquids makes the ideal inside flat wall paint. There are many standard brands of flat wall paints on the market that are worthy of consideration and use.

Fire Retardant Paint
U. S. Army Standard.
W. D. 21.

In any Tint desired.
For Exterior Use on Lumber Construction Wherever Fire Resistance is Desired.

Specification.

White Paint and Tinted Paints made on a White Base.

Pigment 60%.
Liquid 40%.

The pigment portion shall consist of—

Basic Sulphate White Lead.....28%
Zinc Oxide.....22%
Magnesium Silicate, combined with the necessary pure tinting colors to produce the desired shade (a total of)....50%

The liquid portion shall consist of—

Pure Raw Linseed Oil (not less than)—55%

The balance to consist of equal parts of Drier, Turpentine and Volatile Mineral Spirits.

Special Requirements. This paint shall weigh not less than 13 pounds per gallon. When applied to new lumber construction it shall penetrate and dry rapidly to a durable film. It shall successfully withstand the standard firebrand test when applied to two-coat work.

The above named and standard specification applies wherever Fire Retardant Paint is to be used.

WOOD FINISHING MATERIAL.
Orange Shellac Varnish
U. S. Army Standard
W. D. 31.

Specification.

This material shall consist of 4½ pounds of Shellac cut in one gallon of Clear Neutral Denatured Alcohol.*

The Shellac used shall be a high grade Orange Shellac which, when treated with hot 95 per cent Alcohol, will not show a residue of insoluble matter exceeding 1.75 per cent.

The Shellac shall be free from Rosin and other adulterants.

The above standard specification applies wherever Orange Shellac Varnish is used.

* The alcohol used shall be No. 1 Internal Revenue Dept. Standard consisting of 100 gallons of grain alcohol and 5 gallons approved wood alcohol.

LIQUID WOOD FILLER.
U. S. Army Standard
W. D. 52.

Specification.

Pigment 17%.
Liquid 83%.

The pigment portion shall consist of—

Finely divided Silica that will pass through a 200 mesh screen.

The liquid portion shall consist of—

Varnish 77%

The balance to be Turpentine or Volatile Mineral Spirits, or a mixture thereof.

Special Requirements. When applied to wood it shall dry in not more than 5 hours. It shall be of the proper consistency for either brushing or dipping.

The above standard specification applies wherever Wood Filler is to be used.

Generally speaking, there is no great demand for a liquid wood filler. A thin coat of

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shellac or a varnish thinned with turpentine are recommended for use in place of liquid fillers.

Paste Filler for open grained hard-wood finish or floors requires for proper filling and wiping 1⅔ lbs. Silex paste and .14 gal. thinner to the square. Paste Filler is tinted or left transparent according to the color effect desired. One pound of prepared paste filler will fill 40 square feet of surface.

Wiping of paste filler is done with burlap, sea moss or excelsior and should always be done across the grain of the wood as if rubbed with the grain of the wood there is a tendency to lift the filler out of the pores of the wood and waste same, requiring more filler to give satisfactory results.

Thinner for paste filler may be either Turpentine or Benzine if the filler is of best quality of rock quartz, water floated, very finely bolted and mixed with special Japans and Linseed Oil, benzine seems to give the most satisfactory results for a thinner owing to its quicker evaporation. For the cheaper fillers Turpentine must be used.

Varnish is discussed in another article in this book so is omitted here.

Stains for wood work usually form one coat in addition to filler and coats of varnish or wax; these are of three kinds, oil-stain, spirit-stain and water-stain, and are used according to the effect desired.

Oil-Stain averages to require about .16 gal. to the square.

Spirit-Stain averages to require about .16 gal. to the square.

Water-Stain averages to require about .2 gal. to the square.

Prepared Wax averages to require about .33 lbs. to the square.

Gloss Oil is a term used to designate a preparation composed of resin and naptha. This is a very cheap substitute for varnish often used as a size for plastered walls preparatory to tinting. It is a very inferior material and when used as a size softens and roughs with repeated washings. It is ruinous when used as a varnish or as a binder for paint.

Varnish, Best Light Interior, requires for properly coating one square, 1st coat over filler, 1-5 to 1-7 gal.

Varnish, Cheap, Thick Rosin, requires for coating one square one gloss coat, ¼ to ⅕ gal.

Cresote Stain required to dip ⅔ length one M. shingles equals about 2¾ gal.

Cresote Stain required to brush coat one square shingles equals one gal.

Size for plastered walls preparatory to tinting should be varied according to the nature of the treatment to be applied over same and also with reference to the surface on which it is applied. A very good size for this purpose on smooth plastered walls is a coat of medium grade varnish. Such a size would cost about $2.25 per gallon. A standard medium cost size for smooth plastered walls is made up of China wood oil, resin and naptha; such a size could be made up for about $1.50 per gallon. The cheap size commonly used is made up of gloss-oil at a cost of not to exceed 75c per gallon; but taking into consideration lasting quality and labor expended, this is most expensive and unsatisfactory.

Fresco Size satisfactory for use on rough plastered walls may be made up as follows: Dissolve each separately in the proportions of one pound of glue to one gallon of water, one pound common yellow laundry soap to one gallon of water and one-fourth pound of alum to one gallon of water; the glue and soap solutions then being mixed together first, and after thoroughly mixed, the alum solution added and the whole well stirred together ready for application to the wall.

ESTIMATES ON PAINTING.

PAINTER'S ESTIMATE=(units of surface to be covered) × (amount of material required to cover a unit) × (cost of a unit of material) + [(number of hours of labor required by a mechanic to apply the material to a single unit of surface) × (hourly wage of mechanic) × (number of units of surface)] + (overhead charges, including scaffolding, brushes, drop-cloths, cartage, office expense and expense of supervision, etc.) + **(Contractor's profit,** which varies with the supply and demand).

UNITS OF SURFACE USED ARE (one sq. ft.), (sq. yd.=9 sq. ft.) or (square=100 sq. ft.).

AMOUNT OF SURFACE UNITS assumed for estimating purposes is increased at the judgment of the estimator. This is done to make proper allowance for increased labor and waste of material on account of broken and complicated surfaces, and so that prices per unit of labor and material can be maintained constant, the following enumerations being the assumptions most commonly used by estimators.

PLAIN D. & M. Wainscoting or partition stuff is measured once, actual surface, and is used as the standard of comparison. Other surfaces are increased in proportion as their difficulty of execution compares with D. & M. Wainscoting.

Sash for exterior are measured over the entire area instead of around each bar.

Shingle Gable, 1½ × actual surface area.

Dormer Windows 2 × actual surface area.

Shingles, Rough, 1½ to 2 × actual surface area.

Shingles, Dressed, Dimension, actual surface measure.

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Spindle work, measure 4 times solid on one side.

Square Spindle work and pickets, 4 × one side measured solid.

Verandas with heavy columns and railings, etc., measure surface of ceiling and floors and all sides the same as though enclosed. Veranda, very simple in design, measure floor and ceiling and allow double area of brackets and columns.

Outside Blinds, measure 3 × actual surface of one side.

INTERIOR.

Base Boards, measure not less than 1 foot in width regardless of actual width.

Picture Mouldings, measure 1-3 foot in width.

Single Doors, including trim, count as 35 sq. ft. to a side or 70 sq. ft. for both sides.

Interior Side of Windows, including trim and tracing of sash, average at 35 sq. ft.

Wall Decorations, measure ceiling solid and sidewalls 8-10 of actual area to allow for openings, or measure actual area and deduct ½ to ⅔ of all openings.

Badly Weathered wood work or cracked and damaged plaster, add from 1-10 to 3-10 to measurements determined as above.

Prices of standard materials are quoted in market reports and fluctuate with supply and demand. The estimator should verify these preceding each estimate. At time of going to press the following prices obtain:

White Lead Paste, $12.25 per cwt.

Linseed Oil, raw, 85c per gallon.

Turpentine, 82c per gallon.

Paste Filler, about 14c per lb. in 100-lb. packages or 12c in bbls.

Interior Varnishes, about $1.75 to $3.00 per gallon.

Stains vary so much in price that they can not be listed.

First Class Exterior Varnishes, about $4.25 per gallon.

Proprietary Oil Paints of best quality are sold to the painters at about $3.25 to $3.75 per gal., depending on color. The materials in a gal. of White Lead and Linseed Oil "Succeeding Coat" of paint costs exclusive of labor and coloring matter about $2.40 at present market prices and the labor of mixing by hand and the expense for colors brings this hand-mixed paint up in price to about the same as proprietary paints of equal quality. Unless the ingredients composing paint are thoroughly incorporated the paint is not satisfactory. This proper mixing, if done by hand, requires considerable expensive labor.

In figuring the cost per gallon of a lead and oil paint we should not overlook the fact that the only way to correctly figure the price of paint is to figure it by the cost per square yard and not the cost per gallon. One gallon of pure lead zinc and linseed oil paint, machine made, will cover from 350 to 400 square feet per gallon, two coats on the average job, while lead and oil, hand mixed, will cover approximately 225 square feet, two coats.

LABOR REQUIRED.

COST OF LABOR=(number of hours of labor required by a mechanic to apply the material to the single unit of surface) × (hourly wage of mechanics) × number of units of surface).

Wage per Hour=union scale obtaining in the locality where the work is to be executed. (In Chicago this is from 80c to 85c per hour prevailing wage at this time per hour under the award of Judge Landis).

Stopping knots with shellac requires in labor .2 of an hour's time to the square of surface.

Puttying defects in ordinary wood work requires in labor .3 of an hour's time to the square of surface.

Oil Painting, single coat, requires in labor .57 of an hour's time to the square of surface.

Paste Filler Coat, including cleaning of wood work, requires in labor 1.33 hours' time to the square of surface.

Varnish, single coat, including light sandpapering, requires in labor .66 of an hour's time to the square of surface.

Cresote staining of shingles by ⅔ dipping, requires in labor 1 hour of a mechanic's time to dip 1,000 shingles, which average to cover when laid, one square of roof surface.

Cresote staining, one brush coat on roof, requires in labor .8 hour's time to cover one square of surface.

Sizing of plaster walls with either glue or hard oil size requires in labor .33 of an hour's time to the square of surface.

Tinting with water color, fresco tints or calcimine averages to require in labor .44 hour's time to the square of surface to the man employed, providing not less than two men are employed on the work. (Ordinarily, one man cannot work alone at tinting of walls, for if he does so work, the work cannot be satisfactorily done and more time is required in proportion to the surface covered).

Sponging and washing walls requires in labor a variable amount of time to the square according to the amount of size used in coat to be removed and must be approximated by the estimator after examination and test.

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GLASS AND GLAZING

PLATE GLASS.

Sizes and Thickness.—Plate glass can be made under the present improved methods in extreme sizes up to 250 square feet and in such measurements as 10 feet by 21 feet (or 120"x252") containing 210 square feet—12 feet by 20 feet (or 144"x240") containing 240 square feet—13 feet by 19 feet (or 156"x228") containing 247 square feet. Such extraordinary glass is very difficult to make, quite expensive and dangerous to clean or handle and, being especially made to order, entails delay in replacement when broken, requires special flat car shipment and special facilities for unloading and hauling, and the most expert and skilled glaziers in setting. Sizes are usually given in inches.

It is advisable to confine sizes to the ordinary limitations in order to secure prompt and economical deliveries from distributors' stocks.

On account of the extraordinary demand for certain sizes of plate glass for stock sizes in mirrors, windshields for automobiles, and stock door glazing, the proportionate production is below the consumption and a higher value is therefore placed upon these sizes, and their multiples.

¼" to 5/16".—Polished plate glass is manufactured in thicknesses ranging from ⅛" to 1½"; the standard product runs from ¼" to 5/16" full. The other thicknesses (whether thicker or thinner) are made specially, and at an increased cost.

The sash or rabbet for regular plate glass glazing should be made to accommodate glass full 5/16 of an inch thick.

Thick Plate.—⅜", ½", ⅝", ¾", ⅞", 1", 1¼", 1½".

Glass thicker than the standard product is used for counter tops, deal plates, port and deck lights on ships, aquariums, etc.

Thin Plate, ⅛" to 3/16".—One-eighth inch to three-sixteenth inch glass is used largely for residence windows and by car builders and for boat sash, automobile windshields, and for other special purposes where perfect surfaces, high polish and absolute clear vision is wanted, with minimum weight.

Weight.—Plate glass in regular glazing thickness (¼" to 5/16" thick) weighs 3½ lbs. per square foot bare and may be computed at approximately five pounds per square foot boxed for shipment. A rule for figuring shipping weight of plate glass is found in the official price-list as follows:

Extend the glass at 3½ pounds per square foot. Weight of box equals the contents of a plate of greatest width and length of those packed therein, multiplied by 10. Thus:

1 plate, 36"x96" }
1 plate, 60"x84" } =59'x3½=206½ pounds.

Size of box 60"x96"=40' x10=400 pounds.

606½ pounds.

The raw materials may be said to be virtually the same in plate glass as in window glass—the main difference in the finished products being due to the great care exercised in selecting and purifying the ingredients, and the elaborate method of casting, grinding and polishing plate glass as compared to the simple and rapid process of producing window glass from blown cylinders.

Plate glass was first made in France in 1688 and the term "French Plate Glass" or "French Mirrors" has its origin from the development of the plate glass industry in France. The first cast plate made in the United States was produced in 1860 and perfected a few years later so that it may be noted that this is a modern product compared to window glass which was made during the early settlement of this country, at Jamestown, Va., about 1608. The making of ordinary glass has been included in the industries of almost every country in the world and dates back to ancient Egypt, centruies ago.

Ingredients.—The principal ingredients are silica (white-sand) soda (soda-ash) and lime (lime-stone). Also arsenic, charcoal and cullet (broken glass).

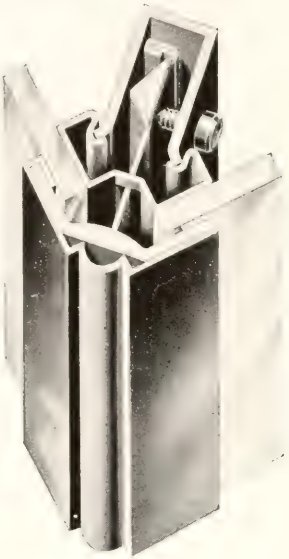
As stated before, the method of producing plate glass widely differs from window glass and it is little known that the melting, casting, rolling, annealing, grinding and polishing of plate involves the mining of silica and coal, the quarrying of limestone, the chemical manufacture of soda-ash on a large scale, the reduction and treatment of fire-clay and an elaborate system of pot-making for crucibles, all of which requires an enormous financial investment, a multitude of men, and extensive factory properties.

It should be stated that the product of the American factories is, by comparison, equal in every way to the European plate glass in clearness, freedom from flaws and defects, homogeneity and finish.

Special Quality and Thickness.—The making of irregular thicknesses, or superfine quality for mirrors or other uses where special glass is needed, requires special processes and entails additional expense in producing, and the making of beveled plates and mirrors necessitates two more elaborate lines of work and machinery and a corps of experts and skilled workmen.

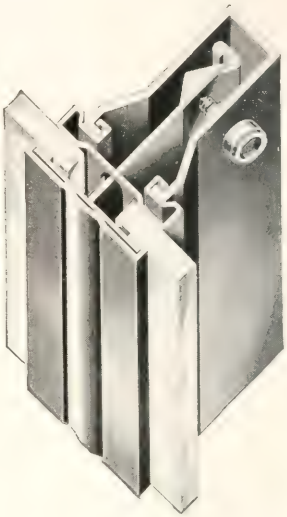
Pot Making.—Pots of fire-clay are such a heavy expense in plate glass manufacture and take so important a part in the successful making of plate glass that the subject deserves special notice. The different clays after being mined are exposed to the weather for some time to bring about disintegration.

At the proper stage finely sifted raw clay is mixed with coarse, burned clay and water. This reduces liability of shrinkage and cracking. It is then "pugged," or kneaded in a mill; kept a long time (sometimes a year)



NO. 200
SAFETY KEY-SET
CORNER BAR

Attention
of
Architect
or
Builder



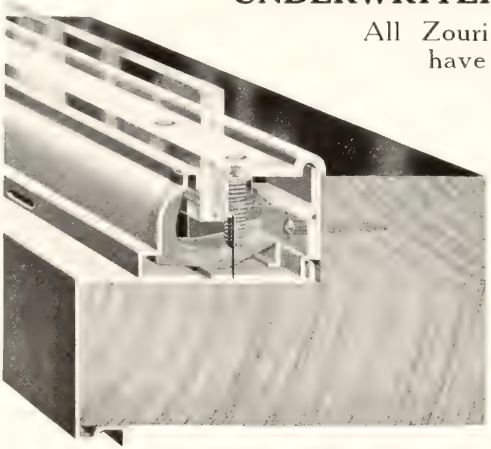
NO. 300
SAFETY KEY-SET
DIVISION BAR

When specifying or purchasing copper store front construction insist upon the types that have been passed on and listed by the

UNDERWRITERS' LABORATORIES

All Zouri Safety Key-Set Construction have been passed on and listed by them and bear their stamp of inspection thus:

Zouri Safety Key-Set Construction
Patented
Underwriters' Laboratories Inspected



NO. 115. SAFETY KEY-SET SASH
WITH SILL COVERING NO. 700

Glazing Specifications:—

All metal sash, corner bars reverse corner bars, division bars and self-adjusting setting blocks used in store fronts must have the **Underwriters' Laboratories** stamp of inspection.

Zouri Drawn Metals Company

Factory and General Offices:
Chicago Heights, Illinois

Also Manufacturers of the International Store Front Construction

in storage bins to ripen; and afterwards goes through the laborious process of "treading." No machinery has thus far been invented by which the plasticity can be developed as does this primitive treading by the bare feet of men. The clay must be treaded many times. The building of the pots is a slow, tedious and time-killing affair; but this is essential.

Without extreme care, some elements used in the making of the pots might be fused into glass while undergoing the intense heat of the furnace; or they might break in the handling, and much depends upon the strength of the pots.

The average pot must hold about a ton of molten glass, and the average furnace heat necessary is about 3,000 degrees Fahrenheit.

After completion comes the proper drying out of the pots; and this is another feature in which the greatest scientific care is required. No pot may be used until it has been left to season for at least three months, and even a year is desirable. And after all this, the pot has but twenty-five days of usefulness.

Melting and Casting.—The pot, having been first brought to the necessary high temperature, is filled heaping full with its mixed "batch" of ground silica, soda, lime, cullet, etc. Melting reduces the bulk so much that the pot is filled three times before it contains a sufficient charge of metal.

When the proper molten stage is reached the pot is lifted out of the furnace by a crane, is first carefully skimmed to remove surface impurities, and then carried overhead by an electric tramway to the casting table. This is a large, massive, flat table of iron, having as an attachment, a heavy iron roller, which covers the full width, and arranged so as to roll the entire length of the table. The sides of the table are fitted with adjustable strips which gauge the production of plates of different thickness. The pasty, or half-fluid glass metal is now poured upon the table from the pot, and the roller quickly passes over it, leaving a layer of uniform thickness. The heavy roller is now moved out of the way, and then by means of a stowing tool the red hot plate is shoved into an annealing oven or lehr. The plates remain for some time in the lehrs, where the temperature is gradually reduced.

When the plate is taken from the annealing ovens it has a rough, opaque, almost undulating appearance on the surfaces. Only the surface, however, for within it is clear as crystal. First, it is submitted for careful inspection, and then goes to the cutter who takes off the rough edges and squares it into the right dimensions; and thence to the grinding room.

Grinding and Polishing.—The grinding table is a large flat revolving platform made of iron, twenty-five feet or more in diameter. This table is prepared by being flooded with plaster of paris and water; then the glass is carefully lowered, and men mount upon the plate and tramp it into place until it is set. After this, greater security is obtained by pegging with prepared wooden blocks; and the table is set in motion. The grinding is done by revolving runners. Sharp sand is fed upon the table, and a stream of water constantly flows over it. After the first cutting by the sand, emery is used in a similar manner. The plates are inspected after leaving the grinding room, and if scratches or defects are found they are marked.

There are also, not infrequently, nicks and fractures found at this stage; and in such case the plate must again be cut and squared, or if the defects are too great, the plate is broken up for cullet. The polishing is done on another special table by means of special reciprocating machinery, using rouge, (iron peroxide), applied with water, and rubbing the glass with blocks of felt so arranged that every part of the plate is brought underneath the rubbing surface. The grinding and polishing has reduced the original plate half of its thickness, sometimes more. The material washed away is lost and fully half the original weight of lime and soda has vanished, and even at the completion, the inspectors very carefully scrutinize the glass for excessive defects and reject that which is not up to quality.

Grading and Quality.—New plate is sea-green, looking at the "metal" through the edge, which gradually fades when exposed for a period to sunlight and weather, to a yellow or light brown color due to the action of the elements upon the chemical constituents of the glass.

In the finished product (glazing quality) there may appear some defects which in no way impair the value, beauty, or durability of the glass for ordinary use—such as small seeds or bubbles, short-finish, reams or surface scratches, which are accepted as contingent with the regular run of plate, and even an open bubble or shot-hole (not clear through both surfaces) is passed in standard glazing quality, providing the plate is comparatively free from other defects and of good color and finish.

Special Quality.—When glass of particular quality is desired, a special selection is necessary. This requires an expert in the grading and selection of the material, sometimes necessitates cutting down larger sizes to minimize the amount of defects inherent with the regular production, and adds a proportionate extra cost to special quality plate.

Beveling.—The beveling of plate glass is of such interest and exemplifies such skill on the part of the workmen that a description of the process should be added to the information already written in the preceding chapter on plate glass.

The glass to be beveled is subjected to treatment in different departments of the beveling plant, each division working out its particular process in taking off the bevel and restoring the surface of the glass to its original polish.

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Store Front Transoms—

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American 3 Way-Luxfer Prism Co.

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1313 S. 55th Court., CICERO, ILL.

Five divisions of skilled workmen are necessary; namely, roughers, emeriers, smoothers, white-wheelers and buffers (polishers) using different abrasive or polishing materials, such as sand or carborundum, emery, sandstone, pumice and rouge.

The roughing-mill or wheel is a circular cast-iron disc having a fine cut corrugated surface about 30" in diameter, revolving rapidly upon its bearings as a horizontal plane. Sand or carborundum is conveyed to the mill from above through a hopper with a stream of water, so that the sand gives the desired roughness between the iron and the glass while the water minimizes the friction and heat.

Roughing.—(1) The edge of the plate is brought into contact with the swiftly moving roughing wheel, and the sand cuts the bevel to the desired depth. Curved and pattern plates with incurves, mitres, etc., require an expert practiced eye and great skill on the part of the operator.

Emerying.—(2) In the first roughing process the beveled surface has been cut so deep by the coarse sand that it is necessary to follow with a finer abrasive in another mill to bring the bevel to a smoother finish, and emery or finer carborundum is used.

Smoothing.—(3) Then the rough grinding is still further smoothed in the stone mill, or smoother, which is constructed upon the plan of the iron roughing wheel, using a circular revolving sandstone of fine texture with water flowing upon it to reduce friction.

Polishing.—(4) The first polishing process is upon a wood wheel in an upright position which brings the bevel to a dull, milky polish by the use of powdered pumice in solution automatically splashed upon the wheel by a paddle.

Finishing.—(5) The final high gloss polish is put upon the beveled surface by the application of rouge upon the upright polishing wheel which is covered with a layer of thick felt.

Regular Bevel 1½".—The standard width of bevel is 1½" and all beveled plate glass or beveled plate mirrors are furnished with 1½" bevel unless otherwise specified.

Slight scratches may be removed from the surface of plate glass by rubbing with pure thick felt mounted upon a hand-block, and using fine red or black rouge (moistened) as an abrasive. This must be skillfully done to avoid over-polishing or "burning" the delicate annealed surface of the plate.

Grinding and Polishing Edges.—The value of plate glass for furniture tops, desks and tables, show-cases, shelves and numerous other purposes has become generally recognized. The covering of glass with treated edges offers a clean, sanitary surface and an elegant appearance and also beautifies, protects and preserves the furniture.

The process of grinding and polishing the edges, or rounding of corners, curves or pattern lines, is similar to the beveling, except that the work is done on the edge of the plate instead of the surface.

The edge of the glass is rough ground, according to specifications, either rounded or squared or chamfered as desired, and finished through the polishing process—described in the previous chapter.

Wheel-Cut Mitred Work.—For decorative effects on door-plates, side-lights, transoms partition-glass, etc., the rich effect of mitred design gives a tone of elegance, and emphasizes the beauty of the glass.

The lines are cut V shape into the surface of the glass by a vertical wheel with sharp edges, and the smoothing and polishing is accomplished by the same general process as on the beveled edge. This is identical in appearance and presents the richness and beauty of the finest cut tableware.

Mitred designs on plate glass mirrors or on rolled figured glass produce an elegant effect where special and elaborate decoration is wanted.

WINDOW GLASS.

The quality of window glass or sheet glass, also termed "blown" or "cylinder glass," has been improved by the modern methods of production, and much has been expended in the effort to make perfect blown cylinder material. Yet there are still some waves and general defects accepted in all window glass, due to the process of making, which differs entirely from cast and polished plate.

The glass is blown in cylinder form and flattened by reheating, which gives it a slight bend or bow, a possible variation in thickness in the larger sizes, and surface flaws.

The selection of the various grades is a matter of expert judgment. The large sheets produced, in single or double thickness and heavier, are cut to stock sizes according to the merits of the glass and graded in "AA," "A" or "B" quality. The defects being eliminated to the greatest possible extent. The ingredients, as we have said, are practically the same in window glass as in plate—it is wholly a matter of refinement and process which produces the different kinds of material.

Window glass is made by two methods—by "machine" or by "hand." The difference is in the blowing process—both producing the cylinder from which all window glass is evolved. The same general treatment of the cylinder, to produce flat sheet glass follows in both machine or human blown material, and both produce equally standard quality.

To make the cylinder the molten glass or "metal" is brought to proper consistency by extreme heat, and the glass in the human blown process is "gathered" upon the end of a tube (or blow pipe) from the furnace and blown into a huge cylinder by repeated heatings and blowings, until the material is all evenly distributed. From a globular mass

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Glass and Glazing

Brasco
COPPER STORE FRONTS

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CHICAGO

about the size of a man's head, the blower swings the pipe into an alley or opening in the floor, blowing as he swings until the full sized cylinder is formed. This requires skill of the highest degree—the blower, by regulating the amount of material entering the cylinder, makes single strength or double strength or heavier glass as desired.

The blowing machine accomplishes the same result by purely mechanical process—the intricate working of the mechanism, the supply of molten glass, the air pressure, rapidity of action, making single or double thickness, being controlled by a single operator who appears to have supernatural powers, surely never dreamed of throughout the great stretch of years when the glass-blower was master of the art and accredited with inimitable skill.

The cylinder is decapitated at both ends by an ingenious method of spinning a string of hot glass at the proper place, or by the use of a wire wrapped around the glass and electrically heated which causes the cap and crown to break off clean. The cylinder is then split lengthwise—placed in the flattening oven on a large circular stone, and as the heat is increased and as the glass begins to wilt it is quickly smoothed out to the shape of the flat stone, upon which it rests.

Cylinder glass cannot be perfectly flattened, and the waviness and bow or slight curve will always occur in this product.

In glazing, the bend or bow should be glazed outward in the sash—the bulge towards the exterior.

Sizes.—Window glass in double strength, or heavier, is made as large as 30"x90" or 38"x86" or 48"x80" and such extreme sizes containing twenty-five square feet, but it is inadvisable to use such glass in these measurements on account of the liability of breakage and the distorted vision due to waves, etc.

The same may be said of the extreme sizes of single strength which can be made up to 24"x60" or 30"x54" or 36"x50" in sizes containing ten or twelve and one-half sq. ft.

Crystal Sheet Glass.—A heavy blown glass, made by the same process as ordinary window glass and subject to the same inherent defects. Graded in "AA," "A" or "B" quality and made in various thicknesses: 26-ounce, 29-ounce, 34-ounce and 39-ounce ($\frac{3}{16}$" thick).

In examining samples of small size for inspection of quality, it should be remembered that the large light of glass will show the natural waves and defects, while the small piece may appear nearly perfect.

It is not altogether a matter of expert judgment to determine the various grades and certain rules may be accepted governing window glass specifications.

Thickness and Weight.—Single strength measures approximately twelve lights to the inch, but a small variation either way is permissible. Single strength weighs approximately 16 ounces to the square foot. Double strength measures approximately nine lights to the inch. The thickness should be fairly uniform and the weight approximately twenty-four ounces to the square foot.

Factory Packages.—Window glass is packed in regular sizes approximately 50 square feet to the box up to the 100 united inch bracket (adding width and length), and 100 square feet to the box in sizes over 100 united inches.

Shipping Weights.—Single strength in factory packages weighs from 65 to 75 pounds to the box (shipping weight). Double strength in factory packages weighs from 85 to 110 pounds to the box, 50 foot boxes, (shipping weight.)

Double strength in 100 feet cases weighs approximately 225 pounds (shipping weight).

"AA" or First Quality.—"AA" quality should be clear glass, free from any perceptible amount of air bubbles or blisters, burnt specks or burns, cords and strings. It should have a good gloss and an even surface and be well flattened. By air bubbles it is understood that tiny blisters, or imperfections not perceptible on the cutters' table, but detectable when placing the sheet directly towards the light, would not be objectionable. This should be a careful selection in both single and double and should represent the very best that can be produced in window glass by the present methods.

"A" or Second Quality.—"A" glass is the normal selection of glass when no special selection is desired or specified and it admits of such defects as small strings or lines, small blisters when not too close to one another or located in the center of the sheet. Well flattened, the surface even, and devoid of noticeable scratches, cropper marks, burns and other prominent defects.

"B" or Third Quality.—"B" glass covers a wider range than either "AA" quality or "A" quality. It permits many of the defects inherent to the process of making such as waves, strings, lines, blisters, scratches, burns and other similar or equivalent defects. This quality embraces everything below "A" quality, not stony or full of blisters or other large defects objectionable for any common purpose, such as heavy scratches, heavy blisters, cords and sulphur stains.

26-oz. Crystal Sheet.—A cylinder or blown glass heavier than the ordinary Double strength, and graded by the same rules as window glass in first, second or third quality, measuring approximately $\frac{1}{8}$" in thickness (technically 125/1000 of an inch).

29-oz. Crystal Sheet.—A heavier blown cylinder glass, graded as above (technically 135/1000 of an inch in thickness).

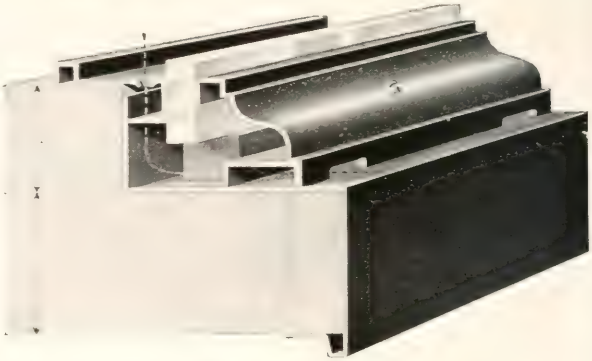
34-oz. Crystal Sheet. — A heavier blown cylinder glass, graded as above, (technically 159/1000 of an inch in thickness).

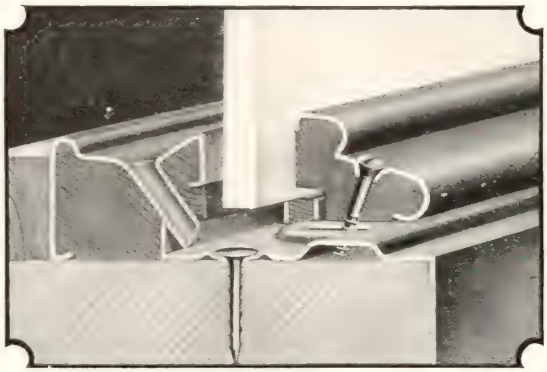
Brasco

"Series 500"

All Copper

Sash





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Simplicity of Design—Assures dignity of appearance and ease of installation.

Indirect Screw Pressure—Glass cannot settle on any screw.

Strength—Heavy gauge copper throughout. Concealed steel reinforcing in all bars.

Safety—Extra wide grip on glass—firm, supple and uniform. The *safest* setting.

Architectural Beauty—Every unit artistically designed.

Improved Drainage and Ventilation—Extra wide gutter—large ventilation ducts.

Low Cost—Uses standard size lumber and minimum millwork.

Permanence—Built to outlast the building.

Brasco

COPPER STORE FRONTS

Brasco Manufacturing Co.

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$\frac{3}{16}$" or 39-oz. Crystal Sheet.—A heavier blown cylinder glass, graded as above, measuring $\frac{3}{16}$" in thickness.

While there is no uniformity in specifications governing the method of glazing different styles of glass, it is nevertheless advisable to call attention to some features which have been developed through the experience of the glass houses in this business.

It is especially desirable that all glass to be specified for a building be placed under one heading in the architect's specifications under the heading, "Glass and Glazing."

Accuracy is a necessity. Use a standard rule, true to gauge; specify the size plainly. For instance, 56 inches might be confused if written 5′ 6″, and cut 66 inches—as 5 feet 6 inches. Always specify width first. In measuring, it is advisable to allow a little play and measure inside the rabbet. See that rabbet is made to accommodate glass of the thickness ordered; i. e., order glass of proper thickness to fit rabbet. Measure the opening and see if all sides are squared. Especially if metal work is to be glazed, it is essential to have perfect fit, and in large sizes it is not uncommon to find a warped frame, or not exactly square, slightly different at one side as compared with the other.

Be specific. It is better to give an abundance of information rather than leave anything indefinite, or to be taken for granted. Mistakes will follow carelessness, and corrections involve loss of time and expense.

Plate glass should rest on two pads of felt, leather, lead, oakum or soft wood blocks, one near each end, not against bare metal, or at a single bearing-point which might cause breakage through settling of building, vibration, etc. The soft wood blocks or lead strips are to be preferred.

Do not fasten or bind glazing-mouldings too tight, as it is necessary to allow for expansion and contraction, vibration and readjustment of construction.

Use pure putty. Have sash-rabbet well oiled or painted so that putty will adhere. Give fresh putty glazing time to set before handling or hanging sash. Don't try to back-putty glass with corrugated or figured surface, as the putty cannot be removed from the ridges in the glass.

Steel sash glazing requires special putty for metal rabbets.

Caution.—When glass of any kind has been delivered to a building packed in cases or with paper between the sheets, it is advisable to store the glass under cover in a dry place and unpack it to avoid stains which come from drying out of damp hay, straw, paper, or other packing materials.

Glaze prism-glass with ribs inside—flat surface outside. Regular glazing is done with uncolored putty. If colored putty is desired it should be specified accordingly. Glass is not bedded in putty or back-puttied unless specially ordered or specified.

Window glass is regularly glazed with the natural bow or bend outside.

WIRE GLASS.

The use of metal frames, metal window sash and fire-proof construction has increased the demand for wire glass until the production of the material amounts to millions of square feet annually. Not only does this glass minimize the fire hazard, but its resisting and sustaining strength, its unyielding qualities even when cracked make it the logical glass for skylights, elevator shafts, stairwells, etc., where these features are a consideration.

Methods of Making.—Wire glass is made by three methods: 1. (Shuman process) by rolling a sheet of glass, laying the wire mesh upon it while the glass is still plastic, pressing the wire netting into the glass, and by a coincident process smoothing the surfaces. 2. (Appert or Schmertz process) by rolling a thin sheet of glass and laying the wire-mesh upon it and simultaneously pouring and rolling a second sheet of glass on top, imbedding the wire. 3. (Continuous or Solid process) by mechanically crimping the wire netting and placing same on the casting table and pouring and rolling the glass over it to produce a sheet of wire glass.

The introduction of the manufacture of wire glass is of so recent a date as to make the volume of consumption all the more surprising, especially when it is recalled that the product was comparatively unknown twenty years ago.

Standard Thickness ¼".—Wire glass is made in sheets as large as 60" wide and 130" long and in several thicknesses — ¼" standard thickness for general use and approved by the National Board of Fire Underwriters.

Other Thicknesses.—Thinner wire glass is obtainable—$\frac{3}{16}$" and ⅛" being made for special purposes, but the universal demand is for ¼" or ⅜" or heavier, and no wire glass less than ¼" thick is accepted under the rules of the Fire Prevention Bureaus or the National Board of Fire Underwriters.

Underwriters' Requirements.—It is necessary to follow certain rules and regulations in the making of fire-proof windows and construction, as provided by the National Fire Protection Association, and a copy of the requirements of the National Board of Fire Underwriters may be obtained from any member of The National Glass Distributers Association.

Extract from Rules and Requirements of the National Board of Fire Underwriters, Edition of 1906.

Thickness of Glass: Wire glass to have a thickness of at least ¼ of an inch at the thinnest point.

Size of Glass: The unsupported surface of the glass allowed, shall be governed by the severity of exposure and be determined in each case by the Underwriters having jurisdiction, but in no case shall it be more than 48 inches in either dimension or exceed 720 square inches.

Windows, doors and partitions should be specified for such sizes as 15"x48", 18"x40", 20"x36" and 24"x30" to conform to the above rule where dimensions are not to exceed 720 square inches. There are also restrictions and regulations governing the depth of rabbet (¾" deep) bearing of glass (⅝") and style of metal frames and sash to meet the demands of fire-retardant construction and permit reglazing, etc.

Polished Wire Glass.—Wire glass is made in ordinary rolled "rough" or "ribbed" or "figured" patterns, and when ground and polished for clear or transparent vision, is specified under the term:—"Polished Wire Glass."

This is not the quality of clear polished plate, but a polished rough wire glass, with the ordinary run of defects inherent with rough glass which has polished surfaces.

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GLASS TOPS FOR FURNITURE
AUTOMOBILE GLASS OF ALL KINDS

MIRRORS

Circles, Ovals and Squares, Beveling, Art Glass
Copper Store Front Construction

Appeal to Architects.

It is especially desirable that all glass to be specified for a building be placed under one heading in the architect's specifications under the heading—"Glass and Glazing."

Accuracy is a necessity. Use a standard rule, true to gauge, specify the size plainly. For instance, 56 inches might be confused if written 5'6", and cut 66 inches—as 5 feet 6 inches. Always specify width first. In measuring, it is advisable to allow a little play and measure inside the rabbet. See that rabbet is made to accommodate glass of the thickness ordered; i. e., order glass of proper thickness to fit rabbet. Measure the opening and see if all sides are squared, especially if metal work is to be glazed, it is essential to have perfect fit, and in large sizes it is not uncommon to find a warped frame, or not exactly square, slightly different at one side as compared with the other.

Be specific—it is better to give an abundance of information rather than leave anything indefinite, or to be taken for granted. Mistakes will follow carelessness, and corrections involve loss of time and expense.

Plate glass should rest on two pads of felt, leather, lead, oakum or soft wood blocks, one near each end, not against bare metal, or at a single bearing-point which might cause breakage through settling of building, vibration, etc. The soft wood blocks or lead strips are to be preferred.

Do not fasten or bind glazing-mouldings too tight, as it is necessary to allow for expansion and contraction, vibration and readjustment of construction.

Use pure putty. Have sash-rabbet well oiled or painted so that putty will adhere. Give fresh putty glazing time to set before handling or hanging sash. Don't try to back-putty glass with corrugated or figured surface, as the putty cannot be removed from the ridges in the glass.

Steel sash glazing requires special putty for metal rabbets.

Caution.—When glass of any kind has been delivered to a building packed in cases or with paper between the sheets, it is advisable to store the glass under cover in a dry place and unpack it to avoid stains which come from drying out of damp hay, straw, paper, or other packing materials.

Glaze prism-glass with ribs inside—flat surface outside. Regular glazing is done with uncolored putty. If colored putty is desired it should be specified accordingly. Glass is not bedded-in-putty or back-puttied unless specially ordered or specified.

Window glass is regularly glazed with the natural bow or bend outside.

METAL STORE FRONT CONSTRUCTION

The use of metal corner-bars, division bars and sills and the all-glass show-case or show-window has become so universal that few old-fashioned stores remain and all modern construction is marked by the absence of bulky posts or ponderous frames.

There are several standard makes of metal store-front construction, corner-bars, dividing bars, metal sill, etc., which fasten or secure, the glass with a metal locking or clamping member and provide for drainage, ventilation and illumination if desired, which may be obtained from the various members of the National Glass Distributers' Association.

We do not enter the brands of the several standard makes or recommend any special style of store-front construction, but it is well to make comparisons, giving attention to the necessity of substantial strength in the retaining members, and using metal bars and construction of sufficient weight to insure strength and rigidity.

It is advisable to send working drawings or detailed plans of store fronts—and the utmost care should be exercised in furnishing accurate dimensions when ordering, so that a true fit of metal may be assured and proper allowance made for bearing contact or play of glass.

The architect should make definite specifications as to the material desired, giving names or numbers of bars, sill covering, jamb bars, jamb covering, transom bars, transom covering, style of metal finish, etc.

All Glass Clamp Store Fronts.—The show window of all-glass patent-front construction needs no special recommendation to those who have examined it, and the unobstructed view of the display as well as the continuous glass effect has made it a popular and attractive model for retail stores throughout the United States.

MIRRORS

The silvered surface of a mirror magnifies and accentuates the qualities of the glass to a great degree; hence it is necessary to use the finest grade of plate to secure good mirrors. This selection of quality necessarily entails the most scrupulous care in making and selecting glass for mirror purposes.

Every consideration must be given to both surface and general character, as the ordinary derects which would otherwise be unnoticed are sharply brought out by the covering of silver.

Silvering.—The formula of the silver solution for making mirrors varies but slightly with the different makers. The secret of success is in the process, and manner of treatment. Cleanliness is absolutely necessary. Chemically pure ingredients, distilled water and expert care with the proper facilities will produce mirrors that will stand for years without deterioration, whether by the cold or hot method.

After a thorough cleansing of the glass, removing all foreign substances from the surface, the "solution" is poured over the plate and by chemical precipitation a coat of pure silver is deposited.

This is permitted to dry and a preservatice coating of shellac, with a coat of mirror-back paint completes the process. This is known as a patent-back mirror and is the standard highest grade.

A method of making mirrors by mercury process was tested for years but found unsatisfactory from a commercial standpoint, and has become obsolete.

Sizes and Thickness.—The sizes of polished plate glass mirrors are limited only by the sizes in which it is possible to make plate glass, and thin or heavy glass may be used as desired.

It must be remembered that extreme sizes in strictly clear plate of mirror quality are difficult to obtain and necessarily carry some ordinary technical defects, which cannot be entirely eliminated. The larger the glass the more likely these defects will appear.

Shocks.—The common sheet-mirror or looking-glass used principally for the reflection of light rather than for the detailed image, is known to the trade as a "Shock-Mirror," and is made from ordinary cylinder glass (window glass) and is very inferior in quality.

Proper Installation.—Mirrors are susceptible to the effects of extreme cold or heat and moisture, and should be mounted with proper protection against dampness. Care should be taken to avoid damp walls, or plaster which has not properly dried out, before installing mirrors.

In glazing French doors with mirrors, or on Colonial work where small mullion glazing is specified, it is essential to have the panels absolutely upon a uniform line and rabbets of accurate depth as the mirrors will otherwise reflect at different angles and distorted vision result.

A perfect effect may be obtained by using a back ground in large size mirror, and a false-mullion over all.

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The following is a list of the publications of the Society; further information regarding same may be obtained from the Financial Secretary.

FORM NO. 21, "INVITATION TO BID"—Letter size, 8½x11 in., two-page document, in packages of fifty at **75c,** broken packages, two for **5c.**

FORM NO. 22, "PROPOSAL"—Letter size, 8½x11 in., two-page documents, in packages of fifty, at **75c,** broken packages, two for **5c.**

FORM NO. 23, "ARTICLES OF AGREEMENT"—Letter size, 8½x11 in., two-page document, in packages of fifty, at **75c,** broken packages, two for **5c.**

FORM NO. 24, "BOND"—Legal size, 8x13 in., one-page document, put up in packages of twenty-five, at **25c** per package, broken packages, three for **5c.**

FORM NO. 25, "GENERAL CONDITIONS OF THE CONTRACT"—Intended to be bound at the side with the specifications, letter size, 8½x11 in., ten-page document, put up in packages of fifty at **$2.50,** broken packages, three for **25c.**

FORM 26, CONTRACT BETWEEN ARCHITECT AND OWNER. Price, **5c** each, in packages of fifty, **$1.25.**

FORM 1, BLANK CERTIFICATE BOOKS—Carbon copy, from 3¾x8½ in., price, **50c.** Two for **5c.**

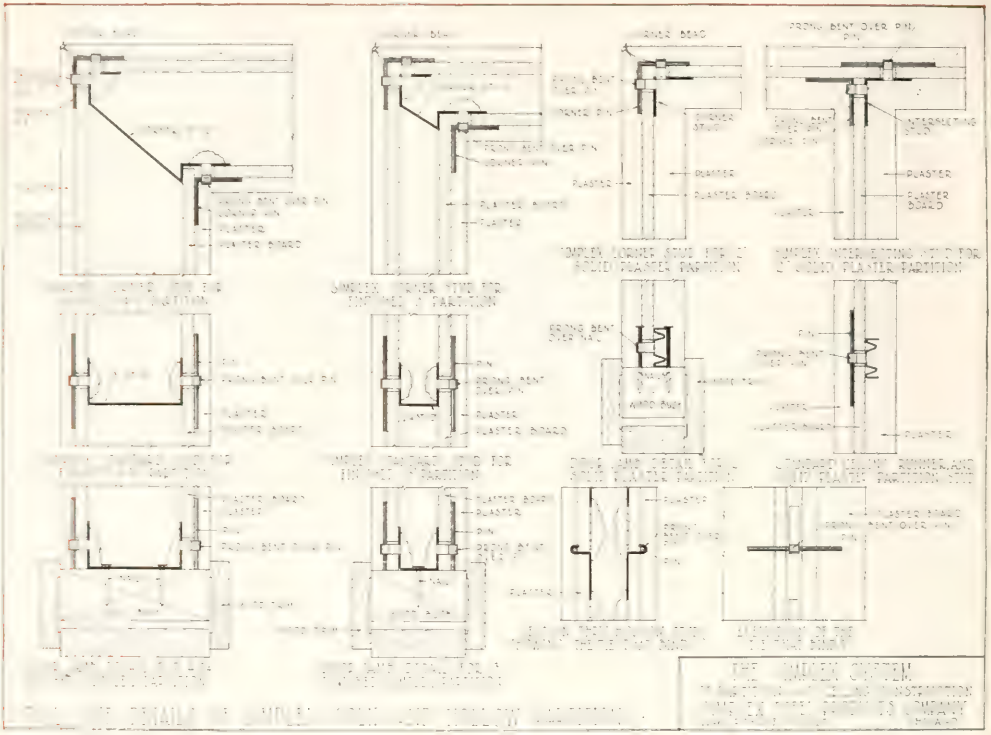
FORM 4, CONTRACT BETWEEN THE OWNER AND CONTRACTOR—(Old Form.) Price, two for **5c.** Put up in packages of 50 for **$1.00.**

FORM E, CONTRACTOR'S LONG FORM STATEMENT—As required by lien law. Price, two for **5c.**

FORM 13, CONTRACTOR'S SHORT FORM STATEMENT—Price, **1c** each.

CODES OF PRACTICE AND SCHEDULE OF CHARGES—8½x11 in. Price, five for **10c.**

These documents may be secured at the Financial Secretary's office, suite 735, 160 N. La Salle St., telephone Cent. 4214. We have no delivery service. The prices quoted above are about the cost of production. An extra charge will be made for mailing or expressing same. Terms strictly cash, in advance, with the order; except that members of the Society may have same charged to their account.



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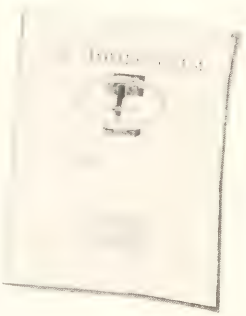

The patented design of the Simplex Stud and method of fastening the plaster board effect marked savings in labor, material and transportation costs. The System is adaptable to all types of buildings.

The subject is so broad and has so many phases that it is impossible to give you a thorough conception of Simplex advantages and methods except through our handbook or a personal demonstration. We shall be glad to give you this information and suggest that you call upon us.

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STANDARD RULES OF THE MEASUREMENT OF PLASTERING.

Adopted by the Employing Plasterers' Association of Chicago.

LATH AND PLASTERING to be measured by the superficial yard, from floor to ceiling for walls, and from wall to wall for ceiling.

In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

No openings to be deducted from "solid" or "hollow" metal lath and plaster partitions nor for openings in suspended ceilings containing less than 100 square feet, where furring is carried around such openings by plasterer. No openings to be deducted from cement wainscot or base.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, "bullnoses," quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of one foot girth or less to be measured on walls by the lineal foot. Plain cornices exceeding one foot girth to be measured by the superficial foot. Add one lineal foot to girth for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches by the piece. Ceiling or frieze plates over eight inches wide by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAINSCOTING AND BASE.

All cement wainscot to be measured by the square foot, and cement base by the lineal foot.

GROUNDS.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 2-coat lath work......⅞ inch
Grounds for 3-coat lath work..... 1 inch
Grounds for 3-coat metal lath work. ⅝ inch
Grounds for 3-coat metal lath work, on ½-inch iron furring......... 1⅛ inch
Grounds for 3-coat metal lath work, on 1-inch iron furring..........1⅝ inch
Grounds for hard mortar metal lath work .... ⅝ inch
Grounds for hard mortar metal lath work, on ½-inch iron furring...1⅛ inch
Grounds for 2-coat work on brick or tile .... ⅝ inch
Grounds for hard mortar on brick or tile ....⅝ inch
Grounds for hard mortar lath work. ⅞ inch
Grounds for plaster board.........⅞ inch

Where metal lath is spoken of it applies to all wire or metal lath.

The Employing Plasterers' Association of Chicago solicit the co-operation and support of Architects and others in the Association's efforts to set the highest standard possible for plastering.

In many of the branches of building construction, efforts are tending towards the use of better material and workmanship, no material or finish for a building combines so fully the essentials for fire protection and sanitation at so low a cost to the owner as does plastering, and no other material that enters so largely into the construction of a building presents so large an area of visible surface as does plastering. The cost of plastering represents only a small percentage of the total cost of a building.

It is a necessary base for the most expensive decorations and in itself provides the requisites necessary for a finish interior. The association believes that so important an element in the construction and finish of a building is worthy of being well done, and that the best workmanship and material if specified and called for will more than compensate owners and architects in their requirements for such grade of work. The Employing Plasterers' Association of Chicago respectfully submits the following outline specification for lath and plaster work; all trade names of material have been omitted. Architects will find a list of standard materials in the Hand Book and elsewhere.

TENTATIVE OUTLINE SPECIFICATION FOR LATH AND PLASTER WORK.

Sand. All sand to be clean, sharp lake sand.

Lime. All lime to be fresh burned lump lime.

Lath. All wood lath to be No. 1 white pine 1½″ lath free from sap and bark and even edged.

Nails. To be 3 penny fine 16 gauge wire nail.

Wire Lath. To be No. 18 Washburn and Moen gauge .0475⅜″ mesh painted or No. 24 gauge metal lath painted with ribs not less than ⅛″ wide, lath cut from sheet metal shall weigh not less than 3.4 lbs. per square yard.

Stucco. To be fresh.

Hair. To be well whipped cattle hair.

Fibre. To be long vegetable fibre.

Portland Cement. To be a brand that shall meet the requirements of the standard specifications for Portland Cement of the American Society for testing materials as revised to date by said Society.

Hard Plaster. To be an approved straight gypsum plaster.

Metal Corner Beads. To be a bead not less than 24 gauge galvanized.

Lathing. All wood lath to be nailed to each stud joist or bearing with joints broken not over seven lath to a break, no diagonal nor vertical lathing allowed, a full ⅜″ key to be left for lime mortar and not less than a full ¼″ for hard plaster.

Lime Mortar. To be composed of clean coarse sand, fresh lump lime and hair and fibre in proper proportions and to be well slaked and protected.

Putty. Lime putty to be run off in a tight putty box, thoroughly tempered and screened through a fine putty screen.

Hard Finish. To be composed of cold run lime putty, fresh plaster of paris and sand to be well troweled to a smooth even surface, free from blisters, checks and other imperfections.

Sand Finish. All float sand finish to be composed of lime putty and sand to be

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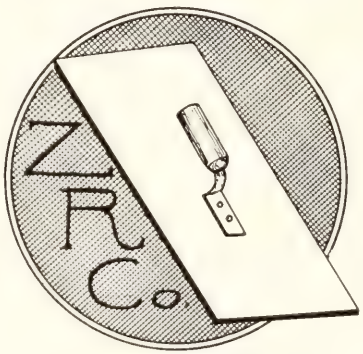

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water floated with a float to an even granular or sand surface.

Scratch Coat. All scratch coating to be well laid on and surface covered with a full coat which is to be scratched with wire scratcher to be well under cut for the brown coat, all lime mortar scratch coating to be dry before applying the brown coat.

Brown Coat. All brown coating to be well applied, allowing only sufficient space for the finish coat, brown coat to be rodded and screeded with all angles straight and true, all hard plaster to be mixed in accordance with the directions of the manufacturer and no hard mortar to be floated with water nor shall any "dead" material be retempered or used.

Wire or Metal Lath. Shall be lapped at each joint or seam and shall be stapled every six inches with blued or galvanized staples.

Band Iron Furring. The following shall be furred with ¼", ½", ¾" or 1" corrugated band iron furring, such furring to be stapled to bearings and the wire or metal lath to be stapled over such band iron furring.

Suspended Ceilings. To be constructed with 1½" or 2" flat bars, angles or channels as may be called for, such principals shall be spaced 4' 0" on centers, hung with flat bar or not less ¼" rod hangers every 4' 0" securely fastened with approved clips to the structural framing or through the floor construction, in the event these hangers go through the floor construction they shall be provided with 6" channels or flat bar anchors, no hanger shall be supported from the bottom flange of the tile arch. The flat bar, angle or channel runners shall be cross furred 12" on centers with ¾" steel channels, securely secured to the principals with rod clips, entire construction to be lathed with No. 18 W. M. gauge ⅜" mesh painted wire lath or No. 24 U. S. Gov. standard gauge metal lath, lath to have lapped edges at each joining and to be tied to the channel furring every 6" with 18 gauge galvanized tie wire.

Furring. All false beam or cornice furring to be constructed of ¾" channel or 1" flat bar brackets not over 2' 0" apart lined out with intermediate furring supports and anchored or toggle bolted into the construction to be made to conform to the design so as to allow for a minimum of plaster, such brackets to be covered with 18 gauge wire or 24 U. S. Gov. gauge metal painted lath secured with 18 gauge galvanized tie wire, such furring to conform to the latest and best practice as to durability of construction.

Cornice Work. All moulded beams and cornices will be screeded and run in place with moulds, with true lines and accurate mitres.

Ornamental Work. All ornamental work to be modeled by artistic modelers who will be approved by the architects. Models to be submitted for approval and no casts to be made until such models have been approved, all patterns to be gotten out by skilled mechanics with true and accurate lines.

Casts. All casts to be well made, the contractor to supply a sufficient number to meet the requirements of the job, all casts to be made in line, well and truly undercut and free from warps and other irregularities supplying all necessary shrinkers and stretchers.

Rough Casting. Lath the exterior of the house with 18 gauge wire or 24 U. S. Gov. metal painted lath stapled over 1" band iron furring scratch coat with mortar composed of 2 vols. of coarse, sharp sand 1 vol. of approved Portland cement, to which mixture add 15% of rich lime mortar, thoroughly scratched and undercut when this coat was "set," brown with mortar composed of 3 vols. sharp sand to 1 vol. Portland cement rod and straighten all surfaces and when this coat has "set" rough cast with mortar composed of 3 vols. of sharp sand or pebbles to 2 vols. Portland cement dashed on surface with a scoop or paddle to an even artistic finish.

Exterior Plastering on Wood Lath. Lath the exterior with No. 1 soft pine one-inch lath, nailed to each stud furring or bearing with not less than a 3 penny nail with full open ⅜" key space and not over seven lath to a break, plaster with 3 coats of cement plaster as called for under exterior plaster on metal lath, note the use of "hard plasters" so called are not recommended for exterior plastering.

Concrete Walls and Columns. All work on concrete walls and columns shall have such concrete well brushed with steel brushes and such concrete shall then be covered with a light coat of an approved bond cement as a bonding coat for the finish coat.

Concrete Ceilings. Shall first be washed with a solution of muriatic acid and such ceilings shall then be plastered as above.

Painted Walls. Walls that are to be coated with waterproofing shall first be scratch coated, then browned and finished.

Patching of Plaster. All patching of plaster damaged by other mechanics shall be paid for at the uniform scale of prices adopted by the Employing Plasterers' Association of Chicago, which scale of prices is set forth in the Hand Book.

Workmen's Compensation. This contractor shall insure his workmen under the provisions of the Workmen's Compensation Laws of the State of Illinois. This contractor shall also insure his liability for injury or death to "the public."

Scaffold. This contractor shall supply all necessary tools, scaffold and other appliances necessary to fulfill the requirements of the job, all scaffolding to be erected and maintained in accordance with the laws of the State relating to scaffolds.

Requirements. By Building Code in buildings of ordinary construction. At least two coats of plaster on all wood lath to ⅞" grounds.

By Union. All plain and ornamental plaster to the same contractor, the base coat of Portland cement under encaustic tile, cement base when installed independent of the floor or if 6" or more in height. All plastering regardless of the nature of the structure or of the material used.

RECOMMENDATIONS.

The use of soft pine lath, specify No. 1 white pine lath nailed to each stud, joist or bearing with 3 d. fine 16 gauge wire nails, with joints broken at least once in each seventh course or lath.

For better residence work specify one inch lath as above.

Wire or metal lath, specify No. 18 Washburn and Moen gauge wire lath ⅜" mesh, painted, or No. 24 U. S. Gov. standard metal lath painted, for better class work specify wire lath woven from galvanized strand or metal lath galvanized.

The use of wire or metal lath plastered insures slow burning construction, helps to prevent settlement cracks and bonds and ties all parts of the structure together, its use is called for in almost every building, particularly on basement ceilings to prevent or retard fire on ceilings with long span joist construction on store ceilings and under other space subject to heavy use or abuse. Its use should also be general in all better class building, in rated buildings its use throughout entitles it to better classification for insurance.

The Association recommends the use of three coat plastering. This will insure a far better class of work, a better bonding together of buildings of ordinary construction, due to the use of a greater body of material. The application of the second base coat enabling one to straighten out rod and line work not possible in the use of two-coat work. Specify three-coat dry work, first coat to be a scratch coat well scratched and un-

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der cut. When dry, apply a brown coat, this brown coat to be screened and rodded and when dry apply a finish coat.

The following suggestions are offered for guidance:

Sand. The use of clean, course, sharp lake sand is essential for good plastering.

Metal Lath. Should be laid with lapped edges or joinings and should be stapled to bearings every 6". No suspended ceilings should be supported from the bottom or soffit of tile.

Portland cement base coat behind encaustic tile, Opalite or kindred material should be specified under "Plastering" with one rodded coat scratched on tile or brick or a scratch and rodded brown coat scratched on metal or wire lath. We do not recommend Portland cement direct to gypsum partition or gypsum furrings.

Damp proofed, waterproofed or painted walls and ceilings are required to be given 3 coats. If a finish coat is desired, it should be so specified. All lathing plain and ornamental plastering should be specified under one heading in order to avoid divided responsibility for final results.

JURISDICTION CLAIMS.

By Plasterers' Union, any and all plastering regardless of the nature of the material, or of the structure to which it is applied, including Scagliola made under the "New Process" so called.

By Lathers' Union, all lathing, metal corner beads and all light iron furring designed, specified or used primarily as a support for lath and plaster, including "Hi Rib."

By Hodcarriers and Building Laborers' Union, all scaffolding erected for the use of plasterers.

PATCHING OF PLASTERING AFTER OTHER TRADES.

Patching of plastering after other mechanics shall not be done as a part of the contract price, and shall be paid for at the following scale of prices which have been adopted by and are recommended by the Employing Plasterers' Association of Chicago.

In accordance with wage agreements effective under the "Landis Award," and present prices of materials, the following scale of prices for patching of plastering after other mechanics and for work done upon a time and material basis, is respectfully submitted.

The prices herein include cost of insurance of men under the provisions of the Workmen's Compensation Laws of the State of Illinois.

Foreman Plaster	$2.75 per hour
Plasterers	2.50 per hour
Foreman Lather	2.00 per hour
Lathers	1.75 per hour
Plasterer Laborer	1.35 per hour
Mortar	3.50 per bbl.
Putty	4.00 per bbl.
Neat Hard Plaster	1.40 per bag
Stucco	1.40 per bag
Metal or Wire Lath	.35 per yard
1½" Pine Lath	.75 per bunch

Owing to abnormal conditions material prices are subject to change without notice, and labor scale will be proportionately increased where bonuses are required to be paid in order to get men. Lathers are Landis scale.

18 gauge ⅜" mesh painted wire lath or 24 gauge expanded metal painted	.35 per yard

Where seven or more men are employed in one gang on same kind of work, foreman's time will be charged continuous while work is going on, where less than seven men are employed in one gang on same kind of work, foreman's time shall be counted one hour for each seven hours of men aggregate time employed on this work, unless foreman's time is required constantly, when he shall be so paid.

CITY ORDINANCE.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 605 of the Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

605. **Wood Lathing and Plastering.)** (a) In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

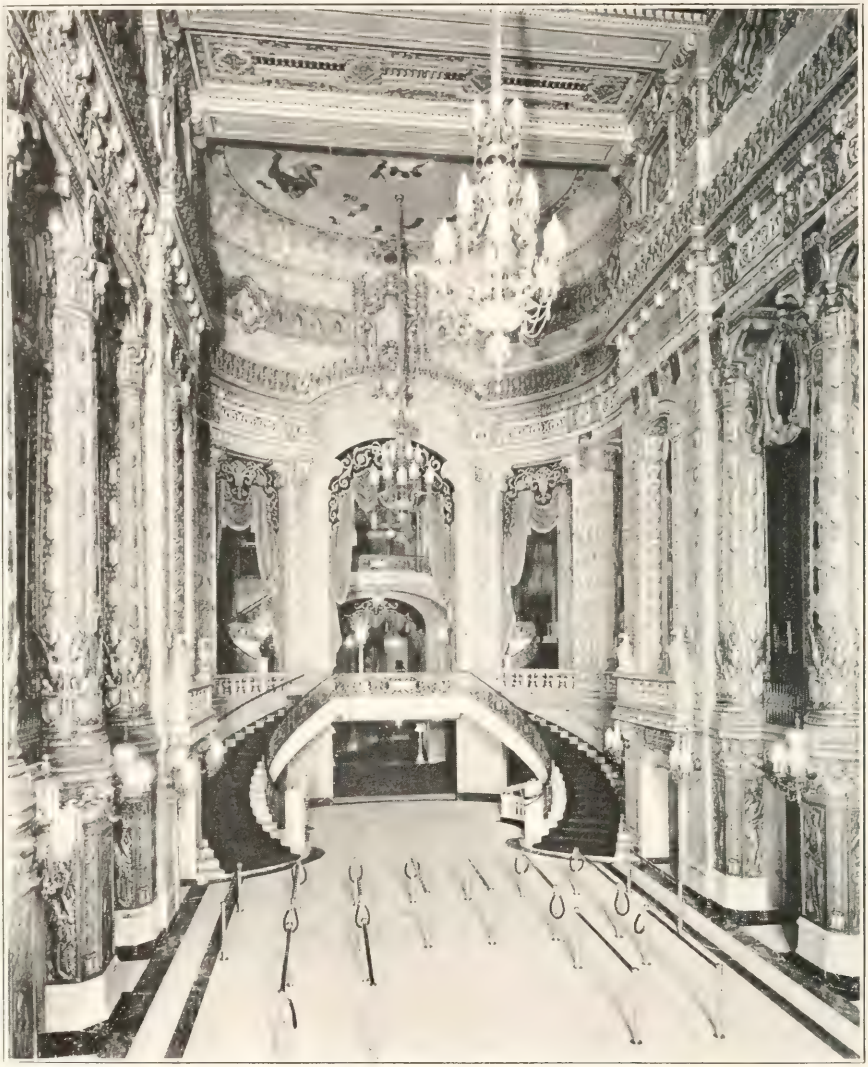
(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

Section 2. This ordinance shall be in force and effect from and after its passage and due publication.



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RULES OF MEASUREMENT FOR MASON WORK

As adopted by the Builders Association of Chicago and the Associated Builders of Chicago.

Introduction.

The following rules are the expression of a custom founded in equity and prevailing in this city from its earliest days.

If to furnish and lay one thousand brick in a plain dead wall cost ten dollars, another piece of brick work of equal cost must be measured as of the same contents, even though it does not take one-fourth as many brick.

The plain dead wall, in stone as well as brick work, is taken as the standard, and more difficult, complicated ornamental and hazardous kinds of work are measured up to it, so as to make the compensation equal. To illustrate: If in one day a man can lay two thousand brick in a plain dead wall, and can lay only five hundred in a pier or arch in the same time, the cost of labor per thousand in such work is four times as much as in a wall, and is entitled to extra compensation; but instead of varying the price, the custom varies the measurement to compensate for the difference and thus endeavors to secure a uniform price per thousand for all descriptions of ordinary brickwork, instead of a different price for the execution of the various kinds of work.

This is the principle underlying the system.

If any new rules or new applications of old rules should be found in the following, we can only say in their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

The units of measurement of masons work are:

For Excavation, the cubic yard.
For Concrete, foundations, the cubic foot.
For Concrete, floors, the superficial foot.
For Dimension stone, footings, the superficial yard.
For Dimension stone, bridge masonry, the cubic foot.
For Dimension stone, surface dressing, the superficial foot extra.
For Rubblework, the cubic foot.
For Rubblework, surface dressing, the superficial foot extra.
For Brickwork, common, the thousand brick.
For Brickwork, pressed, the superficial foot.
For Tuckpointing, cleaning fronts, the superficial foot.
For Plastering, plain surfaces, the superficial yard.
For Plastering, cornices, the running and superficial foot.

Excavation.

To be measured and computed by the actual amount of material displaced—no allowance for rehandling.

Concrete. Floors—Foundations.

Measure actual contents.

Floors to be measured by the superficial foot of surface between walls.

No deductions for tile drains, nor for any pier, chimney breast, plaster or other projections of walls of ten feet or less in area.

Where concrete takes the place of stone or brickwork, figure the contents the same as you would brick or stonework.

It is not safe to do concrete work at less than 30 degrees above zero.

Dimension Stone—Footings.

Footings to be measured each course separately—no deduction for drain or other openings under walls two feet or less in width.

Bridge Masonry.

Compute actual cubic contents.

Surface dressing of all kinds, extra.

It is not safe to do Dimension stone work at less than 25 degrees above zero.

Rubblework.

Footings to be measured by actual contents.

Note.—Footings are all such foundation courses, not exceeding sixteen inches in height each, as are wider than the body of the above.

Note.—In the following the term Corner is used for salient angles of walls, and Angle for re-entering angles.

It is not safe to do rubblework at less than 25 degrees above zero.

External Walls.

Girt building and add thickness of wall for each external angle.

Partition Walls.

Intersection of partition walls two feet or less in width to be measured double; if wider, add four cubic feet to actual contents of every intersection for each foot in length.

Beveled Corners.

For each corner of wall more or less than ninety degrees, add one foot six inches to length of wall.

Circular Walls.

For round walls add one-fifth of length of grit measure.

Pilasters, Etc.

All projections, such as chimney breast, piers connected with walls, and pilasters to be measured actual cubic contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

Piers.

Independent square piers to be measured by the same rule.

Polygon and round pier work at special rates.

Recesses, Etc.

Recesses and slots to be measured solid, and in addition thereto allow one cubic foot for every foot in height.

Arches.

Stone arches are classed as cut-stone work.

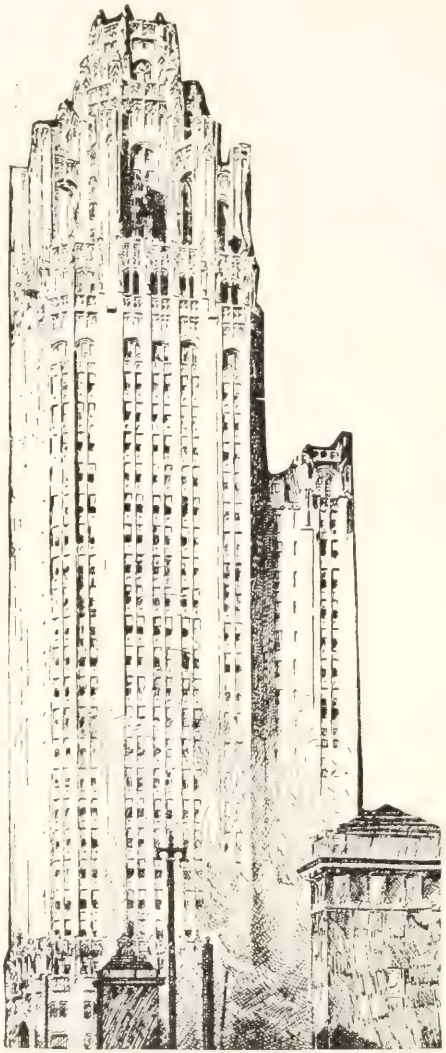
Openings.

Deduct contents of windows, doors and other openings, measuring from top of sill to spring of arch, and add two feet of wall for each jamb for every foot in height of opening.

No deductions are to be made for cut-stone trimmings and lintels.

Brickwork.

Note.—Different cities make different brick; in reality the products of no two brickyards are entirely alike in size, nor, for that matter, all bricks burned in the same kiln. The necessity of acknowledging some standard for purpose of measuration and calculation is obvious. In these rules the dimensions of a brick are understood to be 2 by 4 by 8 inches. We therefore speak of 4-inch walls, meaning the width of one brick; of 8-inch, meaning the width of two-bricks, and 12-inch walls, meaning the length of one and width of another brick, etc., although the actual width of wall will be more or less in excess of these measures.



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Every superficial foot of "one-half brick (or 4-inch) wall" to be estimated at seven and one-half bricks; of "one brick (or 8-inch) wall" at fifteen bricks; of "one-half brick (or 12-inch) wall" at twenty-two and one-half bricks; of "two brick (or 16-inch) wall" at thirty bricks, etc.—increase the number of brick by seven and one-half for every additional half-brick in thickness of wall.

It is not safe to lay brick at less than 20 degrees above zero; brick laid in cement at less than 25 degrees above zero.

External Walls.

If sixteen inches thick or less girt building and add thickness of wall for each external angle.

When thicker, add to actual contents of each corner one and one-half cubic feet for every foot in height.

Allow for wall ends as for corners.

Round Walls.

Sixteen inches thick or less.

For circular walls, or radius sufficiently large to obviate the necessity of using specially molded or cut brick, add one-fifth of length to girt.

When thicker allow for sixteen inches of such wall as per above rule, and measure all in excess as straight work.

Cut or molded at special rates.

Beveled Corners.

For each corner of wall of more or less than ninety degrees, add one foot six inches to length of girt.

Partition Walls.

Sixteen inches thick or less. Intersection of partition walls (bonded together in any manner—not abutting) to be measured double.

When thicker, add one and one-half cubic feet to actual contents of every intersection for each foot in height.

Partition walls connecting with stone walls to be measured one foot into such wall.

Chimney Breasts and Pilasters.

All flues and hollows in chimneys four feet or less in area to be measured solid.

When larger deduct one-half contents of flue.

For all chimney breasts and pilasters add eight inches to face for each corner and multiply length so obtained by width (projection).

Detached chimneys in buildings and plain chimney tops to be measured solid and one-half of one cubic foot to be added for each corners of every foot in height.

Stacks.

Chimney stacks at special rates. When square, find cubic contents, measuring hollow walls solid, and deducting flue. When round or octagon, take length of diameter for side, and measure as though it was square.

Piers.

Independent piers to be measured like chimneys.

Hollow Walls.

Hollow walls to be measured solid.

Stone Fronts.

Stone fronts backed with brickwork, deduct thickness of ashlar from width and figure ordinary walls.

Gables and Wall Tops.

Whenever clipping of brick is required, add to actual contents the length of line of clipping by one foot by thickness of wall.

Cornices and Belts.

If of running courses only, multiply length by height (greatest grit in the cut) by greatest projection.

If enriched (by corbels, brackets and panels), multiply other dimensions, as given, by greatest grit length.

Ledges.

Multiply length by height by greatest projection.

Projections.

All other projections, if four inches or less, to be measured four inches; if above four inches, and not exceeding eight inches, to be measured eight inches; if above eight inches, and not exceeding twelve inches, to be measured twelve inches, etc.

Gauge Work.

Gauge work at special rates.

Openings.

Openings to be measured from top of sill to spring of arch and shortest distance between brick jambs for width.

No deductions to be made for openings two feet six inches or less in width.

One-half of contents to be deducted of openings from two feet six inches to six feet in width.

For openings of more than six feet in width allow one foot six inches by thickness of wall by height for each jamb.

Slots, Panels, Etc.

No deduction to be made for slots, chases, niches, panels or other recesses of four feet or less in width; if wider deduct contents and add two cubic feet of wall for every foot in height.

Trimmings.

No deductions in measuring brickwork for cut-stone or other trimmings, bond-blocks, timber, joists or lintels.

Arches.

Arches—not gauged.

In vaults, multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add to wall measurement.

In sewer and tunnel arches multiply length of extrados by thickness of arch.

Floor Arches and Brick Paving.

Floor arches and brick paving to be measured by the superficial foot and by rule given for measuring concrete. Deduct well-holes.

Brick-Nogging.

Measure as ordinary brickwork. Deduct full openings—no studding.

Cutting.

Cutting of joists or other holes by the piece; of slots, panels and recesses by the lineal foot.

Toothing.

When ordered by the owner or his superintendent to tooth, rack or block, in consequences of delay, of iron, stone or other material, that masonwork may connect with, such toothing, racking or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half, and multiply by one foot of thickness of wall.

Pressed Brickwork.

Measure all exposed surfaces of brick by the superficial foot.

Cut-Stone Setting.

Measure vault covers, flagging, curbing and ashlar by the superficial foot, coping and belt courses by the lineal foot; all other cut stone by the cubic foot.

Tuckpointing and Cleaning.

Tuckpointing and cleaning and pointing stonework to be measured by the superficial foot of exposed surfaces.

Deadening.

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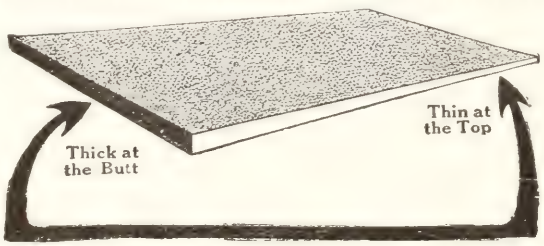

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MISCELLANEOUS AND USEFUL INFORMATION CONCERNING BUILDING ENGINEERING, TRADES AND MATERIALS.

The following pages contain tables, formulae, and miscellaneous information intended to be of assistance to architects in the preparation of plans, specifications, estimates, and the general supervision of the construction work. In order to make the classification simple and to follow a uniform system this matter is classified according to the Dewey System, see page 722, and the file or classification numbers are printed in small type at the head of each piece of matter falling under a different classification. As far as possible the names of authorities quoted are given but in some cases this has been impossible.

RULES AND FORMULAS FOR THE DESIGN OF SIMPLE WOOD BEAMS OR JOISTS.

When a beam is to be designed its length and the loads to which it is to be subjected are known, thus the maximum bending moment may be found.

The allowable-working-strength is assumed in accordance with engineering practice and must not be more than allowed by building laws, locally applicable. This allowable-working-strength is usually stated in municipal codes as a fixed number of pounds per square inch of cross sectional area, for each kind of material. This might just as well be stated in tons or any other unit of weight per square foot or any other unit of area, it being only important that whatever unit of dimension is used that the same unit shall be used both for areas, lengths and breadths.

Breadth-of-the-beam times the-square-of-the-depth divided by six equals Bending-Moment divided by allowable-working-strength per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals weight-to-be-supported-per-unit-of-length times the-square-of-the-total-number-of-units-of-length divided by eight.

For a simple beam loaded with a single weight, the maximum-Bending-Moment (which is to be used in formula) equals the-entire-load times [(the-length-of-the-beam) minus (the-distance-of-the-load-from-the-left-hand-end)] times the-distance-of-the-load-from-the-left-hand-end-of-the-beam divided by the-length-of-the-beam.

If the load be movable the-distance-of-load-from-left-hand-end will be variable and the maximum-moment will be developed when the load is at the middle where the maximum-Bending-Moment is equal to one-fourth-the-load times the-length-of-the-beam. Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 539, Chicago Municipal Code, using the smallest value where there is a difference between compression and tension strength.)

l = length in inches of beam between supports.

b = breadth in inches of the beam.

d = depth in inches of the beam.

w = weight in pounds on beam including the weight of the beam itself per each inch of length.

W = total weight in pounds on beam = l w.

FOR UNIFORM LOADING.

$b = \frac{3\,w\,l^2}{4\,d^2\,S} = \frac{3\,W\,l}{4\,d^2\,S}$ = breadth of beam. $d = \sqrt{\frac{3\,w\,l^2}{4\,b\,S}} = \sqrt{\frac{3\,W\,l}{4\,b\,S}}$ = depth of beam

To find b it is necessary to assume a value for d. Also to find d it is necessary to assume a value for b. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

SAFE STRENGTH OF CONCENTRICALLY AND ECCENTRICALLY LOADED REINFORCED CONCRETE COLUMNS

Benj. E. Winslow, A. I. A., I. S. A., Architectural Engineer, Mem. Am. Soc. C. E.

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NOTATION

A=Total core area in square inches required to take care of a direct load and a moment.
A_1=Area in square inches required to take care of concentric load only.
A_2=Area in square inches required to take care of the bending moment only.
P_1=Total concentric load on column in pounds.
P_2=Total eccentric load on column in pounds.
P=Total equivalent concentric load on column in pounds, or the concentric load which will produce the same maximum stress on the column as the eccentric load P_2.
M=Bending moment on section in inch pounds=P_2e.
C_2=A Constant=$2\left(\frac{y}{r}\right)^2$
E_1=Modulus of elasticity of steel.
E_2=Modulus of elasticity of concrete.
S_2=Section modulus.
I=Moment of inertia of cross section.
r=Radius of gyration of cross section.
d^1=Outer diameter or side of steel reinforcement in inches.
d_2=Inner diameter or side of steel reinforcement in inches.
a=Constant in moment of inertia formula $I=ad^4$.
b=Width or breadth of rectangular column in inches.
d=Core diameter in inches of hooped reinforced concrete column or side of square tied reinforced concrete column.
e=Eccentricity of load P_2 in inches.
f=Average stress in pounds per square inch on entire column section.
f_1=Allowable safe compressive stress as given by the Chicago Building Ordinance, on plain concrete.
f_2=Stress on extreme fibre in lbs. per square inch due to the moment on the section caused by the eccentric load.
$k=\text{Ratio}\frac{f_2}{f}$
m=Constant in radius of gyration formula r=md.
m_1=Constant in section modulus formula $S=m_1d^3$.
p=percentage of vertical steel in column.
p_1=percentage of hooping steel in column.
$n=\text{Ratio}\frac{E_1}{E_2}$
m_1=Constant for the area of a cross section $A=m_1d^2$.

For all reinforced concrete columns.

$$P_1=A_1f \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

when the value (f) varies with the type of the column used and with the reinforcement.

For tied square or rectangular reinforced concrete columns

$$f=f_1\left(1+\frac{p}{100}(n-1)\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Introducing in (2) the ordinance values (2) becomes

for 1 : 2 : 4 Concrete : $f=400\ (1+0.14p)$ (3)
for 1 : 1½ : 3 Concrete : $f=480\ (1+0.11p)$ (4)
for 1 : 1 : 2 Concrete : $f=580\ (1+0.09p)$ (5)

the result of which is given in table (1).

For reinforced concrete hooped columns the Chicago Ordinance requirements leads to the following formula:

$$f=f_1\left(1+\frac{p}{100}(n-1)\right)\left(1+2.5n\frac{p_1}{100}\right). \quad (6)$$

Introducing the ordinance values (6) becomes

for 1 : 2 : 4 concrete: $f=500\ (1+0.14p)\ (1+0.375p_1)$ . . . . . (7)
for 1 : 1½ : 3 concrete: $f=600\ (1+0.11p)\ (1+0.300p_1)$ . . . . . (8)
for 1 : 1 : 2 concrete: $f=725\ (1+0.09p)\ (1+0.25p_1)$ . . . . . (9)

the result of which is given in table (2).

Tables (1) and (2) give the strength of columns for concentric loads only. By help of the method given in the following, they can also be used for eccentric loads:

The direct compressive stress in a short concentrically loaded column is:

$$f=\frac{P_1}{A_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

for which the cross sectional area required to take care of the concentric load is

$$A_1=\left(\frac{P_1}{f}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

When the column load is eccentric, the effect of such a load on the column is the same as the combined effect of

1.) A concentric load $P_1=P_2$
2.) A moment equal to $P_2\times e=M$.

The effect of the concentric load is given by (10) and (11) and the extreme fibre stress due to a moment acting on a section of either a column or a beam, is according to the common theory of flexure:

$$f_2=\frac{M}{S_2}=\frac{P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

The safe allowable bending stress f_2 is often taken at a different value than the safe allowable compressive stress f. Calling the ratio

$$\frac{f_2}{f}=k \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

we obtain from (12)

$$kf=\frac{P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

multiply both sides of the equation with the area A_2

$$A_2kf=\frac{A_2P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad 15)$$

from which we have

$$A_2=\frac{P_2}{f}\frac{e}{k}\frac{A_2}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

The ratio

$$\frac{A_2}{S_2}=\frac{A_2}{\frac{I}{y}}=\frac{A_2y}{I}=\frac{A_2y}{A_2r^2}=\frac{y}{r^2} \quad . \quad . \quad (17)$$

It will also be noted that $\frac{A_2}{S_2}\times d=\frac{A_2d}{S_2}=\frac{m^1d^3}{n^1d^3}=\frac{m^1}{n^1}$

This ratio is thus seen to be a ratio which is dependent upon the shape of this section only and not at all upon the area A_2. It can therefore be applied to any area whatever as long as the shape of this section is the same.

Introducing (17) in (16) and multiplying both numerator and denominator with (d) we obtain after reduction

$$A_2=\frac{P_2}{f}\frac{1}{k}\frac{y^2}{r^2}\frac{e}{d} \quad . \quad . \quad . \quad . \quad . \quad (18)$$

which when constant $C=2\left(\frac{y}{r}\right)^2$ is introduced, becomes

$$A_2=\frac{P_2}{f}\frac{C}{k}\frac{e}{d} \quad . \quad . \quad . \quad . \quad . \quad (19)$$

The total column area required to take care of the concentric load as well as the moment is

Allowable Safe Unit Compression Stress (f) for Tied Reinforced Concrete Columns.

Table 1.

Per Cent of Vert. Steel	Table of f			Per Cent of Vert. Steel	Table of f			Per Cent of Vert. Steel	Table of f		
	n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2		n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2		n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2
0	400	480	580	**1.4**	478	554	653	**2.4**	534	607	705
0.5	428	506	606	**1.5**	484	559	658	**2.5**	540	612	710
0.6	434	512	611	**1.6**	490	564	664	**2.6**	546	617	716
0.7	439	517	617	**1.7**	495	570	669	**2.7**	551	623	721
0.8	445	523	622	**1.8**	501	575	674	**2.8**	557	628	726
0.9	450	528	627	**1.9**	506	580	679	**2.9**	562	633	731
1.0	456	533	632	**2.0**	512	586	684	**3.0**	568	638	737
1.1	462	538	637	**2.1**	518	591	690	. . . . .	. . . . .	. . . . .	. . . . .
1.2	467	543	643	**2.2**	523	596	695	. . . . .	. . . . .	. . . . .	. . . . .
1.3	473	549	648	**2.3**	529	601	700	. . . . .	. . . . .	. . . . .	. . . . .

$$A = A_1 + A_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (20)$$

Introducing in (20) the volume found in (11) and (19) we have

$$A = \frac{P_2}{f} + \frac{P_2}{f}\frac{C}{k}\frac{e}{d} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (21)$$

or $$A = \frac{P_2}{f}\left(1 + \frac{C}{k}\frac{e}{d}\right) \quad . \quad . \quad . \quad . \quad . \quad (22)$$

and finally

$$Af = P = P_2\left(1 + \frac{C}{k}\frac{e}{d}\right) \quad . \quad . \quad . \quad . \quad (23)$$

where Af=P=the equivalent concentric load on the column which produces the same stress on the section as the eccentric load P_2.

Eccentrically loaded columns can therefore be figured same as concentrically loaded columns simply substituting the equivalent load P for the actual eccentric load P_2.

The difficulty in doing this simply consists in obtaining the value of (C). It will be seen from the above that no error whatsoever is made by obtaining the value (C) from the final column section (A) instead of from the moment section A_2. This has therefore been done, and the properties worked out for the final column section A. The properties for the reinforced concrete sections have been obtained by multiplying the steel areas by (n—1) and by finding the properties of the equivalent section in the standard manner, assuming that for round columns the steel area would form a ring of the same area as the steel reinforcing, and for square columns that the steel area would form a hollow square of the same area as the Steel reinforcing, the thickness depending upon the percentage of reinforcing in the column.

It will be too long here to give the mathematics for this. However the resulting formula for the section modulus of the column section was found to be as follows:

$$\text{for } \square \text{ Cols. } S = 0.1667d^3\left\{(n-1)\left(\frac{d_1^4 - d_2^4}{d_1}\right) + 1\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (24)$$

$$\text{for } \bigcirc \text{ Cols. } S = 0.0982d^3\left\{(n-1)\left(\frac{d_1^4 - d_2^4}{d_1}\right) + 1\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (25)$$

By help of table (3) the equivalent concentric load can be found from formula (23) for any case whatsoever. This value can be found for any value of (k). When k=1, or when the allowable bending and compression stress are equal, $\frac{C}{k}$ becomes=C.

In the Chicago Ordinance the ratio $k = \frac{700}{400} = 1.75$, and this value has therefore been used in table (3) for the value $\frac{C}{k}$.

When many columns have to be figured it is somewhat cumbersome to solve (23) for each case. The author has therefore attempted to solve all cases once for all in tables (4) and (5).

From (23) we obtain direct

$$\text{Ratio } \frac{P_2}{P} = \frac{1}{1 + \frac{C}{k}\frac{e}{d}} \quad . \quad . \quad . \quad . \quad . \quad (26)$$

which gives the ratio of the equivalent concentric load to the actual eccentric load. Tables (4) and (5) give this ratio expressed in percentages of the strength of that of a concentrically loaded column The concrete for all columns given in Tables (4) and (5) is assumed to be of a 1 : 1 : 2 mixture. For other mixtures of Concrete the percentage value will be slightly increased. Their exact value can be obtained from table (3) and formula (23).

Tables (4) and (5) show at a glance the weakening effect of applying a load with a given eccentricity. The value in this table for a concentric load will in all cases be 100. The difference between 100 and the percentage given in the tables represents the weakening effect due to the eccentricity.

It has been assumed in this analysis that the neutral axis of the section in all cases would go through the center of gravity of the section. This is in conformity with the common theory of flexure. This assumption only holds good as long as there is no actual tension in the concrete. There will be no actual tension in the concrete as long as

$$\frac{C}{k}\frac{e}{d} < 1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (25)$$

that is as long as the percentages given in tables (4) and (5) are above 50%. It will be noticed that in these tables there are no values below 50, which means that in all cases actual compression will exist over the entire column section.

When actual tension is developed on one side of the column section the neutral axis will move away from the center of gravity of the column section, as the concrete is unfitted to resist tensile stresses. The method of obtaining the properties of the column section under these circumstances become very complicated indeed.

It is fortunate, however, that most cases of eccentrically loaded columns which occur in actual practice will come inside of the range of tables (4) and (5).

In monolytic, reinforced concrete construction there is more or less uncertainty with respect to the eccentricity of the load. For this reason tables (4) and (5) have been made, so that they can be used for any probable eccentricity.

In monolytic reinforced concrete construction the moment found at any rigid joint will divide itself between all of the members

Table 2.

Allowable Safe Unit Compressive Stress on Core-Area of Reenforced Concrete Hooped Columns in Accordance with the Chicago Building Ordinance Requirements. Total Safe Load W = A f — Value of f. (Top Line only.) Values Obtained from Formulas 7, 8 and 9.

Percentages of Hooping Steel	Mix of Concrete	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040	1060	1080	1100
0.5%	1:2 :4	0.56	0.80	1.04	1.28	1.52	1.76	2.00	2.24	2.48	2.72	2.96	3.20	3.44	3.68	3.92	4.17	4.41	4.65	4.89	5.13	5.37	5.60	5.85	6.09
	1:1½:3						0.66	0.92	1.19	1.45	1.71	1.98	2.24	2.50	2.77	3.03	3.29	3.56	3.82	4.08	4.35	4.61	4.87	5.14	5.40
	1:1 :2												0.60	0.88	1.15	1.42	1.69	1.97	2.24	2.51	2.78	3.06	3.33	3.60	3.87
0.6%	1:2 :4			0.79	1.02	1.25	1.49	1.72	1.95	2.19	2.42	2.65	2.89	3.12	3.35	3.59	3.82	4.05	4.29	4.52	4.75	4.99	5.22	5.45	5.69
	1:1½:3							0.67	0.92	1.18	1.44	1.69	1.95	2.21	2.47	2.72	2.98	3.24	3.49	3.75	4.01	4.26	4.52	4.78	5.03
	1:1 :2													0.62	0.88	1.15	1.42	1.68	1.95	2.22	2.48	2.75	3.02	3.28	3.55
0.7%	1:2 :4				0.78	1.00	1.23	1.46	1.68	1.91	2.14	2.36	2.59	2.81	3.04	3.27	3.49	3.72	3.95	4.17	4.40	4.63	4.85	5.08	5.30
	1:1½:3									0.93	1.18	1.43	1.68	1.93	2.18	2.43	2.68	2.93	3.18	3.43	3.68	3.93	4.18	4.43	4.68
	1:1 :2															0.89	1.15	1.41	1.67	1.93	2.19	2.45	2.71	2.98	3.24
0.75%	1:2 :4					0.89	1.11	1.33	1.55	1.78	2.00	2.22	2.45	2.67	2.89	3.12	3.34	3.56	3.78	4.01	4.23	4.45	4.68	4.90	5.12
	1:1½:3									0.80	1.05	1.30	1.55	1.79	2.04	2.29	2.54	2.78	3.03	3.28	3.53	3.77	4.02	4.27	4.51
	1:1 :2															0.76	1.02	1.28	1.54	1.79	2.05	2.31	2.57	2.83	3.09
0.8%	1:2 :4						0.99	1.21	1.43	1.65	1.87	2.09	2.31	2.53	2.75	2.97	3.19	3.41	3.63	3.85	4.07	4.29	4.51	4.73	4.95
	1:1½:3										0.93	1.17	1.42	1.66	1.91	2.15	2.39	2.64	2.88	3.13	3.37	3.62	3.86	4.11	4.35
	1:1 :2																0.89	1.15	1.40	1.66	1.92	2.17	2.43	2.68	2.94
0.9%	1:2 :4							0.97	1.19	1.40	1.62	1.83	2.04	2.26	2.47	2.68	2.90	3.11	3.32	3.54	3.75	3.97	4.18	4.39	4.61
	1:1½:3											0.93	1.17	1.41	1.65	1.88	2.12	2.36	2.60	2.84	3.08	3.32	3.56	3.79	4.03
	1:1 :2																	0.90	1.15	1.40	1.65	1.90	2.15	2.40	2.65
1.0%	1:2 :4									1.17	1.38	1.58	1.79	2.00	2.21	2.42	2.62	2.83	3.01	3.25	3.45	3.66	3.87	4.08	4.29
	1:1½:3													1.17	1.40	1.63	1.86	2.10	2.33	2.56	2 80	3.03	3 26	3.50	3.73
	1:1 :2																			1.15	1.39	1.64	1.89	2.13	2.38
1.1%	1:2 :4										1.15	1.35	1.55	1.76	1.96	2.16	2.36	2.57	2 77	2.97	3.17	3.38	3.58	3.78	3.98
	1:1½:3														1.16	1.39	1.62	1.85	2.07	2.30	2.53	2.76	2.98	3.21	3.44
	1:1 :2																				1.15	1.39	1.63	1.87	2.11
1.2%	1:2 :4												1.33	1.53	1.72	1.92	2.11	2.32	2.51	2.71	2.91	3.10	3.30	3.50	3.70
	1:1½:3																1.38	1.60	1.83	2.05	2.27	2.50	2.72	2.94	3.16
	1:1 :2																						1.39	1.62	1.86
1.25%	1:2 :4													1.42	1.61	1.81	2.00	2.20	2.39	2.59	2.78	2.97	3.17	3.36	3.56
	1:1½:3																1.27	1.49	1.71	1.93	2.15	2.37	2.59	2.81	3.03
	1:1 :2																						1.27	1.50	1.73
1.3%	1:2 :4													1.31	1.50	1.69	1.88	2.08	2.27	2.46	2.65	2.84	3.04	3.23	3.42
	1:1½:3																	1.37	1.59	1.81	2.03	2.25	2.46	2.68	2.90
	1:1 :2																							1.38	1.61
1.4%	1:2 :4															1.48	1.66	1.85	2.04	2.22	2.41	2.60	2.79	2.97	3.16
	1:1½:3																			1.58	1.79	2.01	2.22	2.43	2.65
	1:1 :2																								
1.5%	1:2 :4																	1.63	1.82	2.00	2.18	2.37	2.55	2.73	2.91
	1:1½:3																				1.57	1.78	1.99	2.19	2.40
	1:1 :2																								

NOTE—Figures below top line give percentages of vertical steel in hooped reinforced concrete columns only.

Allowable Safe Unit Compressive Stress on Core-Area of Reenforced Concrete Hooped Columns. (Continued.)

Percentages of Hooping Steel	Mix of Concrete	1120	1140	1160	1180	1200	1220	1240	1260	1280	1300	1320	1340	1360	1380	1400	1420	1440	1460	1480	1500	1540	1580	1620	1660
0.5%	1:2 :4	6.33	6.57	6.81	7.05	7.29	7.53	7.77	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	5.67	5.93	6.19	6.46	6.72	6.98	7.25	7.51	7.77	8.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	4.15	4.42	4.69	4.96	5.24	5.51	5.78	6.05	6.33	6.60	6.87	7.14	7.42	7.69	7.96	.....	.....	.....	.....	.....	.....	.....	.....	.....
0.6%	1:2 :4	5.92	6.15	6.38	6.62	6.85	7.08	7.32	7.55	7.78	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	5.29	5.55	5.80	6.06	6.32	6.57	6.83	7.09	7.34	7.60	7.86	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	3.81	4.08	4.35	4.61	4.88	5.15	5.41	5.68	5.95	6.21	6.48	6.75	7.01	7.28	7.55	7.81	.....	.....	.....	.....	.....	.....	.....	.....
0.7%	1:2 :4	5.53	5.76	5.98	6.21	6.44	6.66	6.89	7.11	7.34	7.57	7.79	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	4.93	5.18	5.43	5.68	5.94	6.19	6.44	6.69	6.94	7.19	7.44	7.69	7.94	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	3.50	3.76	4.02	4.28	4.54	4.80	5.06	5.32	5.58	5.85	6.11	6.37	6.63	6.89	7.15	7.41	7.67	7.93	.....	.....	.....	.....	.....	.....
0.75%	1:2 :4	5.35	5.57	5.79	6.01	6.24	6.46	6.68	6.91	7.13	7.35	7.58	7.80	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	4.76	5.01	5.26	5.50	5.75	6.00	6.25	6.49	6.74	6.99	7.24	7.48	7.73	7.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	3.34	3.60	3.86	4.12	4.38	4.63	4.89	5.15	5.41	5.67	5.92	6.18	6.44	6.70	6.96	7.21	7.47	7.73	7.99	.....	.....	.....	.....	.....
0.8%	1:2 :4	5.16	5.38	5.60	5.82	6.04	6.26	6.48	6.70	6.92	7.14	7.36	7.58	7.80	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	4.59	4.84	5.08	5.33	5.57	5.82	6.06	6.31	6.55	6.79	7.04	7.28	7.53	7.87	8.02	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	3.19	3.45	3.70	3.96	4.21	4.47	4.73	4.98	5.24	5.49	5.75	6.00	6.26	6.51	6.77	7.02	7.28	7.54	7.79	.....	.....	.....	.....	.....
0.9%	1:2 :4	4.82	5.03	5.25	5.46	5.67	5.89	6.10	6.32	6.53	6.74	6.96	7.17	7.38	7.60	7.81	8.02	.....	.....	.....	.....	.....	.....	.....	.....
	1:1½:3	4.27	4.51	4.75	4.99	5.23	5.46	5.70	5.94	6.18	6.42	6.66	6.90	7.13	7.37	7.61	7.85	.....	.....	.....	.....	.....	.....	.....	.....
	1:1 :2	2.90	3.15	3.40	3.65	3.90	4.15	4.40	4.65	4.90	5.15	5.40	5.65	5.90	6.15	6.40	6.65	6.90	7.16	7.41	7.66	.....	.....	.....	.....
1.0%	1:2 :4	4.49	4.70	4.91	5.12	5.33	5.53	5.74	5.95	6.16	6.36	6.57	6.78	6.99	7.20	7.40	7.61	7.82	8.03	.....	.....	.....	.....	.....	.....
	1:1½:2	3.96	4.20	4.43	4.66	4.90	5.13	5.36	5.59	5.83	6.06	6.29	6.53	6.76	6.99	7.23	7.46	7.69	7.93	.....	.....	.....	.....	.....	.....
	1:1 :2	2.62	2.87	3.11	3.36	3.60	3.85	4.09	4.34	4.58	4.83	5.07	5.32	5.56	5.81	6.05	6.30	6.54	6.79	7.03	7.28	7.77	.....	.....	.....
1.1%	1:2 :4	4.18	4.39	4.59	4.79	4.99	5.20	5.40	5.60	5.80	6.00	6.21	6.41	6.61	6.81	7.02	7.22	7.42	7.62	7.83	8.03	.....	.....	.....	.....
	1:1½:3	3.67	3.90	4.12	4.35	4.58	4.81	5.04	5.26	5.49	5.72	5.95	6.17	6.40	6.63	6.86	7.09	7.31	7.54	7.77	8.00	.....	.....	.....	.....
	1:1 :2	2.35	2.59	2.83	3.07	3.31	3.55	3.79	4.03	4.27	4.52	4.76	5.00	5.24	5.48	5.72	5.96	6.20	6.44	6.68	6.92	7.40	7.88	.....	.....
1.2%	1:2 :4	3.89	4.09	4.29	4.48	4.68	4.88	5.07	5.27	5.47	5.67	5.86	6.06	6.26	6.45	6.65	6.85	7.05	7.24	7.44	7.64	.....	.....	.....	.....
	1:1½:3	3.39	3.61	3.83	4.06	4.28	4.50	4.72	4.95	5.17	5.39	5.62	5.84	6.06	6.28	6.51	6.73	6.95	7.17	7.40	7.62	.....	.....	.....	.....
	1:1 :2	2.09	2.33	2.56	2.80	3.04	3.27	3.51	3.74	3.98	4.21	4.45	4.69	4.92	5.16	5.39	5.63	5.87	6.10	6.34	6.57	7.04	7.52	7.99	.....
1.25%	1:2 :4	3.75	3.95	4.14	4.34	4.53	4.72	4.92	5.11	5.31	5.50	5.70	5.89	6.09	6.28	6.47	6.67	6.86	7.06	7.25	7.45	7.84	.....	.....	.....
	1:1½:3	3.25	3.47	3.69	3.91	4.13	4.35	4.57	4.79	5.01	5.23	5.45	5.67	5.90	6.12	6.34	6.56	6.78	7.00	7.22	7.44	7.88	.....	.....	.....
	1:1 :2	1.97	2.20	2.43	2.67	2.90	3.13	3.37	3.60	3.83	4.07	4.30	4.53	4.77	5.00	5.23	5.47	5.70	5.93	6.17	6.40	6.87	7.33	7.80	.....
1.3%	1:2 :4	3.61	3.80	4.00	4.19	4.38	4.57	4.76	4.96	5.15	5.34	5.53	5.72	5.92	6.11	6.30	6.49	6.68	6.88	7.07	7.26	7.64	.....	.....	.....
	1:1½:3	3.12	3.34	3.55	3.77	3.99	4.21	4.43	4.64	4.86	5.08	5.30	5.52	5.73	5.95	6.17	6.39	6.61	6.82	7.04	7.26	7.70	.....	.....	.....
	1:1 :2	1.84	2.07	2.31	2.54	2.77	3.00	3.23	3.46	3.69	3.93	4.16	4.39	4.62	4.85	5.08	5.31	5.54	5.78	6.01	6.24	6.70	7.16	7.63	.....
1.4%	1:2 :4	3.35	3.54	3.72	3.91	4.10	4.29	4.47	4.66	4.85	5.04	5.22	5.41	5.60	5.78	5.97	6.16	6.35	6.53	6.72	6.91	7.28	7.66	.....	.....
	1:1½:3	2.86	3.07	3.29	3.50	3.71	3.93	4.14	4.35	4.57	4.78	4.99	5.21	5.42	5.63	5.85	6.06	6.27	6.49	6.70	6.91	7.34	7.77	.....	.....
	1:1 :2	1.60	1.83	2.06	2.29	2.51	2.74	2.97	3.19	3.42	3.65	3.88	4.10	4.33	4.56	4.78	5.01	5.24	5.46	5.69	5.92	6.37	6.83	7.28	7.74
1.5%	1:2 :4	3.10	3.28	3.46	3.65	3.83	4.01	4.19	4.38	4.56	4.74	4.93	5.11	5.29	5.47	5.66	5.84	6.02	6.21	6.39	6.57	6.94	7.30	7.67	.....
	1:1½:3	2.61	2.82	3.03	3.24	3.45	3.66	3.87	4.08	4.28	4.49	4.70	4.91	5.12	5.33	5.54	5.75	5.96	6.16	6.37	6.58	7.00	7.42	7.84	.....
	1:1 :2	1.37	1.60	1.82	2.04	2.26	2.49	2.71	2.93	3.16	3.38	3.60	3.82	4.05	4.27	4.49	4.72	4.94	5.16	5.39	5.61	6.05	6.50	6.95	7.39

Round Hooped Columns

% of V. Steel	Mix of Concrete	I = ad^4 a	$S_2 = nd^3$ n	r = md m	C = $\frac{Ad}{s}$ C	k = $\frac{700}{400}$ = 1.75 C/k
Plain	1:2 :4	0.0491	0.0982	0.250	8.00	4.571-
	1:1½:3	0.0491	0.0982	0.250	8.00	4.571
	1:1 :2	0.0491	0.0982	0.250	8.00	4.571-
0.5	1:2 :4	0.0553	0.1106	0.248	7.10	4.06
	1:1½:3	0.0539	0.1079	0.248	7.27	4.15
	1:1 :2	0.0530	0.1061	0.248	7.40	4.23
1.0	1:2 :4	0.0615	0.1231	0.246	6.38	3.65
	1:1½:3	0.0588	0.1176	0.248	6.68	3.82
	1:1 :2	0.0570	0.1141	0.247	6.88	3.93-
1.5	1:2 :4	0.0676	0.1353	0.242	5.81	3.32
	1:1½:3	0.0636	0.1272	0.244	6.31	3.60
	1:1 :2	0.0610	0.1221	0.245	6.43	3.67
2.0	1:2 :4	0.0740	0.1480	0.240	5.30	3.06
	1:1½:3	0.0686	0.1373	0.242	5.72	3.26
	1:1 :2	0.0651	0.1302	0.244	6.03	3.44
2.5	1:2 :4	0.0796	0.1593	0.236	4.93	2.81
	1:1½:3	0.0731	0.1462	0.239	5.37	3.07
	1:1 :2	0.0687	0.1375	0.241	5.71	3.26
3.0	1:2 :4	0.0857	0.1715	0.233	4.58	2.62
	1:1½:3	0.0779	0.1558	0.237	5.04	2.88
	1:1 :2	0.0726	0.1453	0.239	5.41	3.09
4.0	1:2 :4	0.0980	0.1960	0.226	4.01	2.29
	1:1½:3	0.0875	0.1750	0.232	4.49	2.57
	1:1 :2	0.0805	0.1611	0.235	4.87	2.78-
5.0	1:2 :4	0.1101	0.2202	0.220	3.57	2.04
	1:1½:3	0.0970	0.1941	0.227	4.05	2.31
	1:1 :2	0.0883	0.1766	0.231	4.45	2.54
6.0	1:2 :4	0.1222	0.2445	0.215	3.21	1.83
	1:1½:3	0.1065	0.2130	0.222	3.69	2.11
	1:1 :2	0.0960	0.1921	0.227	4.08	2.33
7.0	1:2 :4	0.1336	0.2673	0.208	2.94	1.68
	1:1½:3	0.1155	0.2311	0.217	3.40	1.94
	1:1 :2	0.1034	0.2069	0.223	3.80	2.17
8.0	1:2 :4	0.1457	0.2914	0.206	2.70	1.54
	1:1½:3	0.1250	0.2500	0.212	3.14	1.795
	1:1 :2	0.1112	0.2224	0.219	3.53	2.018-

Square Tied Columns

% V. Steel	Mix	Axis	I = ad^4 Val. of a a	$S_2 = nd^3$ Val. of n n	r = md Val. of m m	C = $\frac{Ad}{s}$ C	k = $\frac{700}{400}$ = 1.75 C/k
Plain	All	□	0.0833	0.1667	0.289	6.000	3.43
Plain	All	dia.	0.0833	0.1179	0.289	8.482	4.85
0.5	1:2 :4	□	0.0938	0.1876	0.286	5.330	3.05
		dia.	0.0938	0.1326	0.286	7.541	4.31
	1:1½:3	□	0.0915	0.1831	0.286	5.461	3.12
		dia.	0.0915	0.1295	0.286	7.722	4.41
	1:1 :2	□	0.0900	0.1801	0.287	5.552	3.17
		dia.	0.0900	0.1274	0.287	7.849	4.48
1.0	1:2 :4	□	0.1042	0.2085	0.283	4.796	2.74
		dia.	0.1042	0.1475	0.283	6.780	3.87
	1:1½:3	□	0.0997	0.1995	0.286	5.013	2.86
		dia.	0.0997	0.1412	0.286	7.082	4.05
	1:1 :2	□	0.0968	0.1936	0.286	5.165	2.95-
		dia.	0.0968	0.1369	0.286	7.305	4.17
1.5	1:2 :4	□	0.1148	0.2296	0.280	4.355	2.49
		dia.	0.1148	0.1622	0.280	6.165	3.52
	1:1½:3	□	0.1080	0.2161	0.287	4.627	2.64
		dia.	0.1080	0.1528	0.287	6.544	3.74
	1:1 :2	□	0.1035	0.2071	0.283	4.829	2.76
		dia.	0.1035	0.1464	0.283	6.831	3.90
2.0	1:2 :4	□	0.1256	0.2512	0.277	3.981	2.28
		dia.	0.1256	0.1775	0.277	5.634	3.22
	1:1½:3	□	0.1165	0.2331	0.280	4.290	2.45
		dia.	0.1165	0.1648	0.280	6.068	3.47
	1:1 :2	□	0.1105	0.2210	0.282	4.525	2.59
		dia.	0.1105	0.1563	0.282	6.398	3.66
2.5	1:2 :4	□	0.1352	0.2704	0.272	3.698	2.21
		dia.	0.1352	0.1911	0.272	5.233	2.99
	1:1½:3	□	0.1240	0.2481	0.276	4.031	2.30
		dia.	0.1240	0.1752	0.276	5.708	3.26
	1:1 :2	□	0.1166	0.2333	0.279	4.286	2.45
		dia.	0.1166	0.1650	0.279	6.061	3.46
3.0	1:2 :4	□	0.1455	0.2910	0.269	3.436	1.97
		dia.	0.1455	0.2056	0.269	4.846	2.78
	1:1½:3	□	0.1322	0.2644	0.273	3.782	2.16
		dia.	0.1322	0.1870	0.273	5.348	3.05
	1:1 :2	□	0.1233	0.2466	0.276	4.055	2.32-
		dia.	0.1233	0.1742	0.276	5.741	3.28

meeting at the joint in proportion to their relative rigidities. When the length of the members are the same, the moment of inertia of the cross section will be a direct measure for the rigidity of the member.

Table 63 gives the moment of inertia of column sections. Whenever the moment of inertia of the floor girders are known, the question of how much of the moment each column and each girder will take care of can be determined.

In monolytic reinforced concrete construction the moment at any joint may be caused by any one or all of the following causes:

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. Round Hooped Columns of 1:1:2 Mix. For All Percentages of Hooping Reinforcing. **Table 4.**

Core Diam.	Ecc.	Offset	Plain	1%	4%	8%	Core Diam.	Ecc.	Offset	Plain	1%	4%	8%
	1/4"	1"	87.5	89.0	92.0	94.1		1/2"	2"	88.7	90.2	92.9	94.1
	1/2"	2"	77.8	80.3	85.2	88.8		1"	4"	79.7	82.1	86.7	89.9
8"	1"	4"	63.6	67.1	74.2	79.9	18"	2"	.....	66.3	69.6	76.4	81.7
	2"	.....	.....	50.5	59.0	66.5		3"	.....	56.8	60.5	68.3	74.9
	3"	.....	.....	.....	.....	56.9		4"	.....	.....	53.4	61.8	69.0
	1/4"	1"	88.7	90.2	92.9	94.7		1/2"	2"	89.8	91.1	93.5	95.2
	1/2"	2"	79.7	82.1	86.7	89.9		1"	4"	81.4	83.6	87.8	90.8
9"	1"	4"	66.3	69.6	76.4	81.7	20"	2"	.....	68.6	71.8	78.2	83.2
	2"	.....	.....	53.4	61.8	69.0		3"	.....	59.3	62.9	70.6	76.7
	3"	.....	.....	.....	51.9	59.8		4"	.....	52.2	56.0	64.3	71.2
	1/4"	1"	89.8	91.1	93.5	95.2		1/2"	2"	90.6	91.8	94.1	95.6
	1/2"	2"	81.4	83.6	87.8	90.8		1"	4"	82.8	84.9	88.8	91.6
10"	1"	4"	68.6	71.8	78.2	83.2	22"	2"		70.6	73.7	79.8	84.5
	2"	.....	52.2	56.0	64.3	71.2		3"	.....	61.6	65.1	72.6	78.4
	3"	.....	.....	.....	54.5	62.3		4"	.....	54.6	58.3	66.4	73.2
	1/4"	1"	90.6	91.8	94.1	95.6		1/2"	2"	91.2	92.4	94.5	96.0
	1/2"	2"	82.8	84.9	88.8	91.6		1"	4"	83.8	86.0	89.6	92.3
11"	1"	4"	70.6	73.7	79.8	84.5	24"	2"	.....	72.4	75.4	81.2	85.6
	2"	.....	54.6	58.3	66.4	73.2		3"	.....	63.6	67.1	74.2	79.9
	3"	.....	.....	.....	56.9	64.5		4"	.....	56.8	60.5	68.3	74.9
	1/2"	2"	84.0	86.0	89.6	92.3		1/2"	2"	92.4	93.5	95.2	96.5
	1"	4"	72.4	75.4	81.2	85.6		1"	4"	86.0	87.7	91.0	93.3
12"	2"	.....	56.8	60.5	68.3	74.9	28"	2"	.....	75.4	78.1	83.4	87.4
	3"	.....	.....	50.5	59.0	66.5		3"	.....	62.9	70.4	77.0	82.2
	4"	.....	.....	.....	51.9	59.8		4"	.....	60.5	64.0	71.6	77.6
	1/2"	2"	86.0	87.7	91.0	93.3		1/2"	2"	93.4	94.3	95.9	97.0
	1"	4"	75.4	78.1	83.4	87.4		1"	4"	87.5	89.0	92.0	94.1
14"	2"	.....	60.5	64.0	71.6	77.6	32"	2"	.....	77.8	80.3	85.2	88.8
	3"	.....	50.5	54.3	62.7	69.8		3"	.....	70.0	73.0	79.3	84.1
	4"	.....	.....	.....	55.7	63.5		4"	.....	63.6	67.1	74.2	79.9
	1/2"	2"	87.5	89.0	92.0	94.1		1/2"	2"	94.0	94.8	96.2	97.3
	1"	4"	77.8	80.3	85.2	88.8		1"	4"	88.7	90.2	92.9	94.7
16"	2"	.....	63.6	67.1	74.2	79.9	36"	2"	.....	79.7	82.1	86.7	89.9
	3"	.....	53.8	57.5	65.7	72.6		3"	.....	72.4	75.4	81.2	85.6
	4"	.....	.....	50.5	59.0	66.5		4"	.....	66.3	69.6	76.4	81.7

(1) By the column above being eccentric with respect to the column below.

(2) By the unbalanced moments at the face of the column in beams or girders framing into the columns from opposite sides.

(3) By the beam or girder being placed eccentric with respect to the column axis.

The moments caused by the second and third of these items may or may not be of the same sign as that of the eccentric load from the column above.

Roughly speaking, we would err on the safe side by assuming that the total moment will be divided equally between the column above and the column below.

When the columns in two consecutive stories are flush on one side and are offset on the other side, as is often the case with wall columns the eccentricity of the axis of the two columns will be ½ of the offset. If then each column takes half the moment, the eccentricity for each column will be ¼ of the offset. This assumption although a rough one, has been made in tables (4) and (5) in order to assist in getting a line on the real eccentricity for the case in hand. Of course on this basis the maximum eccen-

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. **Table 5.**

Axis Parallel with Side of Column							Axis Taken Diagonally with Column						
			Square Tied Columns, 1:1:2 Mix						Square Tied Columns, 1:1:2 Mix				
Core Diam.	Ecc.	Offset One Side	Plain	1%	2%	3%	Core Diam.	Ecc.	Offset 2 Con. Sides	Plain	1%	2%	3%
8″	¼″	1″	90.3	91.6	92.5	92.3	8″	¼″	1″	86.9	88.5	89.8	90.7
	½″	2″	82.4	84.5	86.1	87.3		½″	2″	76.8	79.4	81.4	83.0
	1″	4″	70.0	73.0	75.6	77.5		1″	4″	62.3	65.7	68.6	70.9
	2″	.....	53.8	57.5	60.8	63.3		2″	.....	.....	.....	52.2	54.9
	3″	.....	.....	.....	50.8	53.5		3″	.....	.....	.....	.....	.....
9″	¼″	1″	91.3	92.4	93.3	94.0	9″	¼″	1″	88.1	89.6	90.7	91.7
	½″	2″	84.0	85.9	87.4	88.6		½″	2″	78.8	81.2	83.1	84.6
	1″	4″	72.4	75.3	77.7	79.5		1″	4″	65.0	68.3	71.1	73.3
	2″	.....	56.8	60.4	63.5	66.0		2″	.....	.....	51.9	55.1	57.8
	3″	.....	.....	50.4	53.7	56.4		3″	.....	.....	.....	.....	.....
10″	¼″	1″	92.1	93.1	93.9	94.5	10″	¼″	1″	89.2	90.6	91.6	92.4
	½″	2″	85.4	87.1	88.6	89.6		½″	2″	80.5	82.8	84.5	85.9
	1″	4″	74.5	77.2	79.4	81.2		1″	4″	67.3	70.6	73.2	75.3
	2″	.....	59.3	62.9	65.9	68.3		2″	.....	50.8	54.5	57.7	60.4
	3″	.....	.....	53.0	56.3	59.0		3″	.....	.....	.....	.....	50.4
11″	¼″	1″	92.8	93.7	94.4	95.0	11″	¼″	1″	90.9	91.3	92.3	93.0
	½″	2″	86.5	88.2	89.5	90.5		½″	2″	82.0	84.0	85.8	87.0
	1″	4″	76.2	78.9	81.0	82.6		1″	4″	69.4	72.5	75.0	77.0
	2″	.....	61.6	65.1	68.0	70.4		2″	.....	53.2	56.9	60.0	62.7
	3″	.....	51.7	55.4	58.7	61.2		3″	.....	.....	.....	50.0	52.8
12″	½″	2″	87.5	89.0	90.3	91.2	12″	½″	2″	83.2	85.2	86.7	88.0
	1″	4″	77.8	80.3	82.3	83.8		1″	4″	71.2	74.2	76.6	78.6
	2″	.....	63.6	67.0	69.9	72.2		2″	.....	55.3	59.0	62.1	64.6
	3″	.....	53.8	57.5	60.8	63.3		3″	.....	.....	.....	52.2	54.9
	4″	.....	.....	50.4	53.7	56.4		4″	.....	.....	.....	.....	.....
14″	½″	2″	89.1	90.5	91.6	92.3	14″	½″	2″	85.3	87.0	88.4	89.5
	1″	4″	80.3	82.6	84.4	85.8		1″	4″	74.3	77.0	79.2	81.0
	2″	.....	67.1	70.3	73.0	75.1		2″	.....	59.1	62.7	65.6	68.1
	3″	.....	57.6	61.2	64.4	66.8		3″	.....	.....	52.8	56.0	58.7
	4″	.....	50.5	54.2	57.5	60.2		4″	.....	.....	.....	.....	51.6
16″	½″	2″	90.3	91.6	92.5	92.3	16″	½″	2″	86.8	88.5	89.8	90.7
	1″	4″	82.4	84.5	86.1	87.3		1″	4″	76.7	79.4	81.4	83.0
	2″	.....	70.0	73.0	75.6	77.5		2″	.....	62.3	65.7	68.6	70.9
	3″	.....	60.9	64.4	67.3	69.7		3″	.....	52.4	56.1	59.3	61.9
	4″	.....	53.8	57.5	60.7	63.3		4″	.....	.....	.....	52.2	54.9

tricity exists at one or both ends of the column and the eccentricity at any point along the length of the column can easily be determined.

Reviewing the results in table (2), which represents the safe allowable unit compressive stresses allowed by the Chicago Building Ordinance, it will be observed that for the highest percentages of steel practically the same strength is obtained for the different mixtures of concrete. When the ordinance was drawn up the author pointed out that the empirical rule of the Chicago Ordinance allowed a lean mixture to obtain a greater strength than a rich mixture of concrete. The committee then made the rule that no leaner mixure than 1:2:4 was to be allowed in reinforced concrete columns. Table (2) shows that this rule did not take care of the matter completely. The commitee should

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. **Table 5.**

Axis Parallel with Side of Column							Axis Taken Diagonally with Column						
			Square Tied Columns, 1:1:2 Mix						Square Tied Columns, 1:1:2 Mix				
Core Diam.	Ecc.	Offset One Side	Plain	1%	2%	3%	Core Diam.	Ecc.	Offset 2 Con. Sides	Plain	1%	2%	3%
18″	½″	2″	91.3	92.4	93.3	94.0	18″	½″	2″	88.1	89.6	90.7	91.7
	1″	4″	84.0	85.9	87.4	88.6		1″	4″	78.8	81.2	83.1	84.6
	2″	.....	72.4	75.3	77.7	79.5		2″	.....	65.0	68.3	71.1	73.3
	3″	.....	63.6	67.0	69.9	72.2		3″	.....	55.3	59.0	62.1	64.6
	4″	.....	56.8	60.4	63.5	66.0		4″	.....	.....	51.9	55.1	57.8
20″	½″	2″	92.1	93.1	93.9	94.5	20″	½″	2″	89.2	90.6	91.6	92.4
	1″	4″	85.4	87.1	88.6	89.6		1″	4″	80.5	82.8	84.5	85.9
	2″	.....	74.5	77.2	79.4	81.2		2″	.....	67.3	70.6	73.2	75.3
	3″	.....	66.1	69.3	71.5	74.2		3″	.....	57.9	61.5	64.5	67.0
	4″	.....	59.3	62.9	65.9	68.3		4″	.....	50.8	54.5	57.7	60.4
22″	½″	2″	92.8	93.7	94.4	95.0	22″	½″	2″	90.1	91.3	92.3	93.0
	1″	4″	86.5	88.2	89.4	90.5		1″	4″	82.0	84.0	85.8	87.0
	2″	.....	76.2	78.9	81.0	82.6		2″	.....	69.4	72.5	75.0	77.0
	3″	.....	68.1	71.3	73.9	76.0		3″	.....	60.2	63.7	66.7	69.1
	4″	.....	61.6	65.1	68.0	70.3		4″	.....	53.2	56.9	60.0	62.7
24″	½″	2″	93.3	94.2	94.9	95.4	24″	½″	2″	90.8	92.0	92.9	93.0
	1″	4″	87.5	89.0	90.3	91.2		1″	4″	83.2	85.2	86.7	88.5
	2″	.....	77.8	80.3	82.3	83.8		2″	.....	71.2	74.2	76.6	85.3
	3″	.....	70.0	73.0	75.6	77.5		3″	.....	62.3	65.7	68.6	70.9
	4″	.....	63.6	67.0	69.9	72.2		4″	.....	55.3	59.0	62.1	64.6
28″	½″	2″	94.3	95.0	95.6	96.1	28″	½″	2″	92.0	93.0	93.9	94.4
	1″	4″	89.1	90.5	91.5	92.3		1″	4″	85.3	87.0	88.4	89.5
	2″	.....	80.3	82.6	84.4	85.8		2″	.....	74.3	77.0	79.2	81.0
	3″	.....	73.2	76.0	78.3	80.1		3″	.....	65.8	69.1	71.8	74.0
	4″	.....	67.1	70.3	73.0	75.1		4″	.....	59.1	62.7	65.6	68.1
32″	½″	2″	95.0	95.6	96.2	96.5	32″	½″	2″	92.9	93.9	94.6	95.1
	1″	4″	90.3	91.6	92.5	93.3		1″	4″	86.8	88.5	89.8	90.7
	2″	.....	82.4	84.5	86.1	87.3		2″	.....	76.7	79.4	81.4	83.0
	3″	.....	75.7	78.4	80.5	82.2		3″	.....	68.7	71.9	74.5	76.5
	4″	.....	70.0	73.0	75.6	77.5		4″	.....	62.2	65.7	68.6	70.9
36″	½″	2″	95.4	96.1	96.5	96.9	36″	½″	2″	93.7	94.5	95.1	95.6
	1″	4″	91.3	92.4	93.3	94.0		1″	4″	88.1	89.6	90.7	91.3
	2″	.....	84.0	85.9	87.4	88.6		2″	.....	78.8	81.2	82.9	84.6
	3″	.....	77.8	80.3	82.2	83.8		3″	.....	71.2	74.2	76.6	78.6
	4″	.....	72.4	75.3	77.7	79.5		4″	.....	65.0	68.3	71.1	73.3

also have established a maximum limit of stress for each mixture of concrete, as for example:

1100 lbs. for 1 : 2 : 4 concrete
1300 lbs. for 1 : 1½ : 3 concrete and
1630 lbs. for 1 : 1 : 2 concrete.

Unfortunately the ordinance allows this highest stress for the 1:2:4 concrete. However, any competent engineer, who is alive to the fitness of things will not use such high stresses in his own work. This shows that even the rules given in the ordinance may lead to unscientific design when used without judgment. Even when these recommendations are lived up to the Chicago Ordinance requirements for reinforced concrete columns are not too conservative, as many would lead us to believe, as there are still too many uncertainties both in the design, material and workmanship for such columns.

TABLES OF WORKING STRESSES IN ORDINARY STRUCTURAL DESIGN

By BENJAMIN E. WINSLOW, M. W. S. E.

The tables and data given on pages 358, 359 and 360 are extracts from articles published by Mr. Winslow in "The Technograph"—(Editor)

Ultimate and Safe Strength of Wood in Pounds Per Square Inch

MATERIAL	Extreme Fiber Stresses			Compression with the Grain			Compression Across the Grain			Modulus of Elasticity		Weight per Cubic Foot	
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate			
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	From	To
Long Leaf Pine	7000	14000	1500	6000	9000	1500	1000	2000	350	1,500,000	2,250,000	40	50
Oregon Pine	7000	13000	1400	6000	9000	1400	900	1800	300	1,400,000	2,100,000	35	45
White Oak	6000	12000	1300	5000	8000	1300	1500	3000	500	1,300,000	1,950,000	45	55
Short Leaf Pine	6000	11000	1200	5000	8000	1200	900	1800	300	1,200,000	1,800,000	35	45
Spruce	5000	10000	1100	4000	7000	1100	800	1600	250	1,100,000	1,650,000	30	40
Norway Pine	5000	9000	1000	4000	6000	1000	700	1400	200	1,000,000	1,500,000	30	40
White Pine	4000	8000	900	4000	6000	900	600	1200	200	900,000	1,350,000	25	30
Fir	4000	7000	800	3000	5000	800	600	1200	200	800,000	1,200,000	25	30
Hemlock	3000	6000	700	3000	4000	700	600	1200	200	700,000	1,050,000	25	30
Cedar	3000	5000	600	3000	4000	600	500	1000	200	600,000	900,000	20	25

MATERIAL	Shear with the Grain			Shear Across the Grain			Tension with the Grain			Elastic Limit		Modulus of Resilience
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate		
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	
Long Leaf Pine	400	800	150	4000	6000	1000	8000	15000	1700	6000	12000	3.0
Oregon Pine	400	700	140	4000	5000	900	8000	14000	1600	6000	11000	3.0
White Oak	400	1000	200	4000	6000	900	7000	14000	1500	5000	11000	3.0
Short Leaf Pine	350	700	120	3000	5000	800	7000	13000	1400	5000	10000	2.5
Spruce	300	600	110	3000	4000	800	6000	12000	1300	4000	9000	2.5
Norway Pine	300	600	100	3000	4000	700	6000	11000	1200	4000	8000	2.5
White Pine	300	600	90	2000	3500	600	5000	10000	1100	3500	7000	2.0
Fir	250	500	80	2000	3000	500	5000	10000	1000	3000	6000	2.0
Hemlock	200	400	70	2000	3000	500	4000	9000	900	2500	5000	2.0
Cedar	200	400	60	2000	2500	400	4000	8000	800	2500	4500	1.5

Ultimate and Safe Strength of Concrete in Pounds Per Square Inch

Modulus of Elasticity of P. C. Stone Concrete 1:2:4—60 Days Old for Various Stresses	Modulus of Elasticity	Strength of 1:2:4 P. C. Stone Concrete for Various Ages	Compression on Top Fibers of Beams			Modulus of Elasticity	
			Ultimate		Safe	Ultimate	
	Ultimate		From	To	Av.	From	To
Initial Mod. of Elasticity....	2,000,000	1 Day Old	200	300	0		
E. for Stress of 400 lbs pr. □	1,700,000	2 " "	400	700	100		
" " " 600 " "	1,600,000	4 " "	600	1000	200	800,000	1,300,000
" " " 800 " "	1,500,000	7 " "	900	1500	375	1,200,000	2,000,000
" " " 1000 " "	1,400,000	1 Month Old.....	1200	2000	500	1,600,000	2,600,000
" " " 1200 " "	1,300,000	2 " "	1400	2300	575	1,800.000	3,000,000
" " " 1400 " "	1,100,000	3 " "	1500	2500	625	2,000,000	3,300,000
" " " 1600 " "	900,000	6 " "	1600	2700	675	2,200,000	3,600,000
" " " 1800 " "	600,000	1 Year Old.....	1700	2900	725	2,300,000	3,800,000
E. for Ultimate Strength....	0	2 " "	1800	3000	750	2,400,000	4,000,000

These tables will cover variations of the material and give the range of strength that could be expected of good ordinary materials and workmanship. Inferior materials will come below the lowest limits given in these tables, and superior materials will come above the highest limits. The safe compressive unit stress to be used for long columns should be obtained from the use of some approved column formulae, which also should take care of possible eccentric applications of the load.

The safe extreme fiber stress for long, narrow beams and girders, including plate girders, not braced sideways, should also be obtained from some approved column formulae. In this manner the lateral strength of beams is provided for.

The following method is believed to conform with good practice for computing loads in buildings:

Figure all parts of the building for the full dead load.

Figure joists and beams for the full live load.

Figure girders for 85 to 90 per cent of the live load.

Figure the columns supporting the roof and top story of a building for the full live load. For each succeeding story below, make a reduction of 5 per cent in the full live load coming on the columns. This reduction must however, not exceed 50 per cent of the full live load for a many stored building.

Figure the foundations for one-third of the full live load.

Ultimate and Safe Strength of Masonry in Pounds Per Square Inch.

MATERIAL	Compression			Safe Bearing	Modulus of Elasticity		Shear			Tension			Weight per Cubic Foot	
	Ultimate		Safe		Ultimate		Ultimate		Safe	Ultimate		Safe		
	From	To	Av.		From	To	From	To	Av.	From	To	Av.	From	To
Hard Brick Work in P. C.	2000	3000	200	275	1,500,000	2,500,000	.....	.....	.....	100	200	20	130	150
Common " P. C.	1500	2500	175	250	1,500,000	2,500,000	150	300	20	100	200	20	110	130
" " N. C.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
" " P C. & LM.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
Old Brick Work in P. C.	2000	3000	200	275	2,000,000	3,000,000	.....	.....	.....	120	250	25	110	130
" " " N. C.	1500	2500	175	250	1,500,000	2,000,000	.....	.....	.....	70	120	15	110	130
" " " L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	25	50	7	110	130
Brick Piers in P. C.....	1500	2500	175	250	1,500,000	2,500,000	.....	.....	.....	100	200	20	110	130
" " L. M.....	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
Rubble Work in P. C...	1000	2000	150	200	1,500,000	2,500,000	.....	.....	.....	70	150	20	130	150
Coursed Rubble in P. C..	1500	2500	175	250	2,000,000	3,000,000	.....	.....	.....	100	200	20	140	160
Neat P. C.....	2000	4000	200	300	1,500,000	3,000,000	1200	2400	300	400	800	70	80	90
Neat N. C.....	1000	3000	175	250	1,000,000	2,000,000	700	1500	125	200	400	30	60	70
P. C. Mortar 1 : 3	1500	2500	175	250	1,000,000	2,000,000	200	400	35	200	400	30	120	130
N. C. Mortar 1 : 2	800	1500	150	200	800 000	1,500,000	150	300	25	100	200	20	120	130
Lime Mortar.....	200	400	100	150	500,000	800,000	50	100	10	20	40	5	90	110
P. C. Stone Concrete 1:2:4	1500	3500	400	500	1,500,000	3,500,000	800	1200	125	200	400	40	140	150
N C. " " 1:2:5	1000	2000	200	300	1,000,000	2,000,000	500	1000	80	150	300	25	140	150
P. C. Cinder 1:2:5	800	1600	150	200	500,000	1,000,000	70	120	10	100	150	20	100	110
Granite	12000	20000	400	600	3,000,000	6,000,000	1200	2400	300	1200	2400	200	160	180
Limestone.....	6000	12000	350	500	2,000,000	5,000,000	1000	2000	175	1000	2000	175	150	170
Sandstone.....	5000	10000	300	400	1,000,000	3,000,000	800	1600	125	800	1600	125	140	160
Brick and Tile.....	2000	5000	200	300	1,000,000	3,000,000	500	1000	80	500	1000	80	120	140

ULTIMATE AND SAFE STRENGTH OF IRON AND STEEL IN POUNDS PER SQUARE INCH

Material	Compression			Safe Bearing	Shear			Modulus of Elasticity		Weight per Cu. Ft.
	Ultimate		Safe Average		Ultimate		Safe	Ultimate		
	From	To			From	To	Average	From	To	
Hard Steel	36,000	40,000	18,000	26,000	45,000	55,000	12,000	28,000,000	31,000,000	490
Medium Steel	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Steel Pins	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Shop Rivets	24,000	29,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Field Rivets	24,000	29,000	12,000	20,000	50,000	60,000	10,000	"	"	"
Cast Steel	60,000	90,000	12,000	26,000	50,000	60,000	12,000	29,000,000	32,000,000	"
Cast Iron	60,000	90,000	10,000	15,000	15,000	25,000	2,000	12,000,000	18,000,000	450

Material	Extreme Fiber Stress			Tension			Elastic Limit		Modulus of Resilience
	Ultimate		Safe Average	Ultimate		Safe Average	Ultimate		
	From	To		From	To		From	To	
Hard Steel	50,000	70,000	18,000	65,000	75,000	18,000	35,000	45,000	35
Medium Steel	40,000	60,000	16,000	60,000	70,000	16,000	30,000	40,000	35
Steel Pins	40,000	60,000	24,000	60,000	70,000	16,000	30,000	40,000	
Shop Rivets	40,000	60,000	24,000	48,000	58,000		24,000	30,000	
Field Rivets	40,000	60,000	18,000	46,000	54,000		24,000	30,000	
Cast Steel	60,000	90,000	16,000			18,000	35,000	50,000	
Cast Iron	30,000	40,000	3,500			3,000	10,000	20,000	1.2

PERCENTAGE OF HOOPING FOR VARIOUS CORE DIAMETERS AND HOOPING FOR HOOPED REINFORCED CONCRETE COLUMNS.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

MAXIMUM PITCH OF SPIRALS TO BE NOT GREATER THAN 1/10 THE DIAM. OF COL. NOR GREATER THAN 3″

Diameter of Core / Pitch	3/16″ Hooping		¼″ Hooping					5/16″ Hooping							⅜″ Hooping							Minimum No. of Rods
	1⅜″	1½″	1½″	1⅝″	1¾″	1⅞″	2″	1½″	1⅝″	1¾″	1⅞″	2″	2¼″	2½″	1⅝″	1¾″	1⅞″	2″	2¼″	2½″	2¾″	3″	
9	0.89	0.82	1.46																				
10	0.80	0.74	1.31																				
11	0.73	0.67	1.19																				
12	0.67	0.61	1.09	1.01	0.94	0.87	0.82	1.71	1.57	1.46	1.36	1.27	1.14	1.03						1.46	1.34	1.24	6
13	0.62	0.57	1.01	0.93	0.87	0.81	0.75	1.58	1.45	1.35	1.25	1.17	1.06	0.95					1.50	1.36	1.24	1.14	6
14	0.57	0.53	0.94	0.87	0.81	0.75	0.70	1.46	1.35	1.25	1.17	1.09	0.98	0.88				1.58	1.40	1.26	1.15	1.06	6
15	0.54	0.49	0.87	0.81	0.75	0.70	0.65	1.36	1.26	1.17	1.09	1.02	0.91	0.82			1.57	1.47	1.31	1.17	1.07	0.99	6
16	0.50		0.82	0.76	0.70	0.66	0.61	1.28	1.18	1.10	1.02	0.96	0.85	0.77		1.58	1.47	1.38	1.23	1.11	1.01	0.93	6
17	0.47		0.77	0.71	0.66	0.62	0.58	1.21	1.11	1.03	0.96	0.90	0.81	0.72		1.49	1.39	1.30	1.16	1.03	0.95	0.87	6
18			0.73	0.67	0.63	0.58	0.54	1.14	1.05	0.97	0.91	0.85	0.76	0.68	1.51	1.40	1.31	1.22	1.09	0.98	0.89	0.82	8
19			0.69	0.64	0.59	0.55	0.52	1.08	1.00	0.93	0.86	0.81	0.72	0.65	1.43	1.33	1.24	1.16	1.04	0.92	0.84	0.72	8
20			0.66	0.61	0.56	0.52	0.49	1.02	0.95	0.88	0.82	0.76	0.68	0.61	1.36	1.26	1.18	1.12	0.98	0.88	0.80	0.74	8
21			0.62	0.58	0.54	0.50		0.98	0.90	0.84	0.78	0.73	0.65	0.58	1.30	1.20	1.12	1.05	0.94	0.84	0.76	0.70	8
22			0.60	0.55	0.51	0.48		0.93	0.86	0.80	0.75	0.70	0.62	0.56	1.24	1.15	1.07	1.00	0.89	0.80	0.73	0.67	8
23			0.57	0.53	0.49			0.89	0.82	0.76	0.71	0.67	0.59	0.53	1.18	1.10	1.02	0.96	0.85	0.77	0.70	0.64	8
24			0.55	0.50				0.85	0.79	0.73	0.68	0.64	0.57	0.51	1.13	1.05	0.98	0.92	0.82	0.74	0.67	0.62	9
25			0.52	0.49				0.82	0.76	0.70	0.66	0.61	0.55	0.49	1.09	1.01	0.94	0.87	0.79	0.71	0.64	0.59	9
26			0.50					0.79	0.73	0.67	0.63	0.59	0.53		1.05	0.97	0.91	0.85	0.76	0.68	0.62	0.57	9
27			0.49					0.76	0.70	0.65	0.61	0.57	0.51		1.01	0.94	0.87	0.82	0.73	0.65	0.60	0.55	9
28								0.73	0.68	0.63	0.59	0.55	0.49		0.97	0.90	0.84	0.79	0.70	0.62	0.57	0.53	10
29								0.71	0.65	0.60	0.57	0.53			0.94	0.87	0.81	0.76	0.68	0.61	0.55	0.51	10
30								0.68	0.63	0.58	0.55	0.51			0.91	0.84	0.79	0.73	0.66	0.59	0.54	0.49	10
32								0.64	0.59	0.55	0.51	0.48			0.85	0.79	0.74	0.69	0.61	0.55	0.50		11
34								0.60	0.56	0.52	0.48				0.80	0.74	0.69	0.65	0.58	0.52	0.47		12
36								0.57	0.53	0.49					0.76	0.70	0.66	0.61	0.55	0.49			13
38								0.54	0.50						0.72	0.67	0.62	0.58	0.52				13
40								0.51	0.47						0.68	0.63	0.59	0.55	0.49				14
42								0.50							0.65	0.60	0.56	0.53					15
44								0.47							0.62	0.57	0.54	0.50					15
46															0.59	0.55	0.51	0.48					16
48															0.57	0.53	0.49						17
50															0.54	0.51							18
52															0.52	0.49							18
54															0.50								19

NOTE: Values inside of heavy lines are within the limits set by the Chicago Building Ordinance. See Sec. 546-567.

Hooping Rods	7/16" Hooping								½" Hooping								9/16" Hooping						
Pitch	1¾"	1⅞"	2"	2⅛"	2¼"	2½"	2¾"	3"	1¾"	1⅞"	2"	2⅛"	2¼"	2½"	2¾"	3"	1⅞"	2"	2¼"	2½"	2¾"	3"	
16						1.50	1.37	1.25															6
17					1.57	1.41	1.29	1.18								1.53							6
18				1.57	1.48	1.33	1.22	1.11							1.59	1.45							8
19				1.49	1.40	1.26	1.16	1.05							1.50	1.37							8
20		1.60	1.51	1.41	1.33	1.29	1.10	1.00						1.57	1.43	1.30							8
21		1.53	1.43	1.35	1.27	1.14	1.04	0.95						1.50	1.36	1.24						1.58	8
22	1.56	1.46	1.37	1.29	1.22	1.09	1.00	0.91					1.59	1.43	1.30	1.18						1.51	8
23	1.49	1.39	1.31	1.23	1.16	1.07	0.95	0.87					1.52	1.37	1.24	1.13						1.44	8
24	1.43	1.34	1.25	1.18	1.11	1.00	0.91	0.83				1.54	1.45	1.31	1.19	1.09					1.51	1.38	9
25	1.37	1.28	1.20	1.13	1.07	0.96	0.88	0.80			1.57	1.48	1.40	1.26	1.14	1.04					1.45	1.33	9
26	1.32	1.23	1.16	1.09	1.03	0.93	0.84	0.77			1.51	1.42	1.34	1.21	1.10	1.01				1.53	1.39	1.28	9
27	1.27	1.19	1.11	1.05	0.99	0.89	0.81	0.74		1.55	1.45	1.37	1.29	1.16	1.06	0.97				1.47	1.34	1.23	9
28	1.23	1.15	1.07	1.01	0.96	0.86	0.77	0.72	1.60	1.50	1.40	1.32	1.25	1.12	1.02	0.93			1.58	1.42	1.29	1.18	10
29	1.18	1.10	1.04	0.98	0.92	0.83	0.75	0.69	1.55	1.44	1.35	1.27	1.20	1.08	0.99	0.90			1.52	1.37	1.25	1.14	10
30	1.14	1.07	1.00	0.94	0.89	0.80	0.73	0.67	1.50	1.40	1.31	1.23	1.16	1.05	0.95	0.87		1.61	1.47	1.32	1.20	1.10	10
32	1.07	1.00	0.95	0.88	0.84	0.75	0.68	0.63	1.40	1.31	1.23	1.15	1.09	0.98	0.89	0.82		1.51	1.38	1.24	1.13	1.04	11
34	1.01	0.94	0.88	0.83	0.79	0.71	0.64	0.59	1.32	1.23	1.15	1.09	1.03	0.92	0.84	0.77	1.56	1.46	1.30	1.17	1.06	0.98	12
36	0.95	0.89	0.83	0.79	0.74	0.67	0.61	0.56	1.25	1.16	1.09	1.02	0.97	0.87	0.79	0.73	1.47	1.38	1.23	1.10	1.00	0.92	13
38	0.90	0.84	0.79	0.75	0.70	0.63	0.58	0.53	1.18	1.10	1.03	0.97	0.92	0.83	0.75	0.69	1.40	1.31	1.16	1.05	0.95	0.87	13
40	0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50	1.12	1.05	0.98	0.92	0.87	0.79	0.71	0.65	1.33	1.24	1.10	0.99	0.90	0.83	14
42	0.82	0.76	0.72	0.67	0.64	0.57	0.52	0.48	1.07	1.00	0.94	0.88	0.83	0.75	0.68	0.62	1.26	1.18	1.05	0.95	0.86	0.79	15
44	0.78	0.73	0.68	0.64	0.61	0.55	0.50		1.02	0.95	0.89	0.84	0.79	0.71	0.65	0.60	1.20	1.13	1.00	0.90	0.82	0.75	15
46	0.75	0.70	0.65	0.62	0.59	0.52	0.49		0.98	0.91	0.85	0.80	0.76	0.68	0.62	0.57	1.15	1.08	0.96	0.87	0.79	0.72	16
48	0.72	0.67	0.63	0.59	0.56	0.50			0.94	0.87	0.82	0.77	0.73	0.65	0.60	0.55	1.10	1.03	0.92	0.83	0.75	0.69	17
50	0.69	0.64	0.60	0.57	0.54	0.48			0.90	0.84	0.79	0.74	0.70	0.63	0.57	0.52	1.06	0.99	0.88	0.80	0.72	0.66	18
52	0.66	0.62	0.58	0.54	0.51				0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50	1.02	0.96	0.85	0.77	0.70	0.64	18
54	0.64	0.59	0.56	0.52	0.49				0.83	0.78	0.73	0.68	0.65	0.58	0.53	0.49	0.98	0.92	0.82	0.74	0.67	0.61	19
56	0.61	0.57	0.54	0.50					0.80	0.75	0.70	0.66	0.62	0.56	0.51		0.95	0.89	0.79	0.71	0.65	0.59	20
60	0.57	0.53	0.50	0.47					0.75	0.70	0.65	0.62	0.58	0.52			0.88	0.83	0.74	0.66	0.60	0.55	21

Core Diameter, for Column Diameter add 4"

FORMULAS FOR CONCRETE COLUMNS ACCORDING TO THE CHICAGO BUILDING ORDINANCES.

I. For All Concrete Columns:

W=Af W=Total safe load in lbs.

A =Total cross section area of columns in sq. ins. for II.
 =Total cross section area inside of hooping in sq. ins. for III.

f =Average allowable unit stress in lbs. per sq. in. (in II and III).

p =Percentage of vertical steel (expressed in whole numbers).

p′ =Percentage of hooping steel (expressed in whole numbers).

II. Reinforced Concrete Columns

1:1:2 Concrete f=580 (1+0.09p) =580+52.2p

1:1½:3 Concrete f=480 (1+0.11p) =480+52.8p

1:2:4 Concrete f=400 (1+0.14p) =400+56p

III. Hooped Reinforced Concrete Columns:

1:1:2 Concrete f=725 (1+0.25p′) (1+0.09p) =(1+.25p′) (725+65.25p)

1:1½:3 Concrete f=600 (1+.30p′) (1+0.11p) =(1+.30p′) (600+66p)

1:2:4 Concrete f=500 (1+.375p′) (1+.14p) =(1+.375p′) (500+70p)

Maximum height of columns must not exceed 12 × diameter, and no column shall have a cross section area of less than 64 sq. in.

(See Sec. 552 Building Ordinances of Chicago, Ill.)

TABLE I.

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Safe Extreme Fiber Stresses for Reinforced Concrete Beams in Accordance with the Chicago Building Ordinance Requirements for Concrete of Various Mixtures and Various Safe Stresses in the Steel Reinforcement. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.					Stress in steel.	
	1:1:2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.	16000.	18000.
0.00	58	48	40	35	30	0	0
0.01	11	11	11	11	11	9	11
0.02	21	21	21	21	21	19	21
0.03	31	31	31	31	31	28	31
0.04	41	41	41	41	41	37	42
0.05	50	50	50	50	50	45	50
0.06	60	60	60	60	60	55	60
0.07	70	70	70	70	70	65	70
0.08	80	80	80	80	80	70	80
0.09	90	90	90	90	90	80	90
0.10	100	100	100	100	100	90	100
0.11	115	115	115	110	110	100	115
0.12	125	125	125	120	120	110	125
0.13	135	135	135	130	130	120	135
0.14	145	145	145	140	140	125	145
0.15	150	150	150	145	145	135	150
0.16	160	160	160	155	155	145	160
0.17	170	170	170	165	165	150	170
0.18	180	180	180	175	175	160	180
0.19	190	190	190	185	185	170	190
0.20	205	205	205	200	200	180	205
0.22	220	220	220	215	215	195	220
0.24	240	240	240	235	235	210	240
0.26	260	260	260	250	250	230	260
0.28	280	280	275	270	270	245	275
0.30	300	300	295	295	290	265	295
0.32	320	320	315	315	310	280	315
0.34	335	335	330	330	325	295	330
0.36	355	355	350	350	345	310	350
0.38	375	375	370	370	365	330	375
0.40	395	395	390	390	385	345	390
0.42	415	415	410	400	400	365	410
0.44	430	430	425	420	420	380	425
0.46	450	450	445	440	440	395	445
0.48	470	470	465	460	455	410	465
0.50	490	485	480	475	470	430	480
0.52	510	505	500	495	490	445	515
0.54	525	520	515	510	505	460	515
0.56	545	540	535	530	515	480	535
0.58	565	560	555	550	520	495	555
0.60	585	580	575	570	530	510	575
0.62	600	595	590	585	535	525	595
0.64	620	615	610	595	540	540	610
0.66	640	635	630	600	540	560	630
0.68	660	655	650	605	545	575	650
0.70	675	670	665	610	550	590	665
0.72	695	690	680	620	555	605	670
0.74	715	710	685	625	560	620	700
0.76	730	725	690	630	565	635	720
0.78	750	745	695	635	570	655	735
0.80	770	760	700	635	575	670	755
0.82	790	780	710	640	580	685	770
0.84	805	795	715	650	585	700	790
0.86	820	805	720	655	590	715	805
0.88	840	810	725	660	595	730	825
0.90	860	815	730	660	600	750	840
0.92	875	820	735	665	600	765	860

See note on following page.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.					Stress in steel.	
	1:1:2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.	16000.	18000.
0.94	895	825	740	670	605	780	875
0.96	920	835	745	675	610	795	895
0.98	930	840	750	680	615	810	910
1.00	950	845	755	685	620	825	930
1.1	980	870	780	700	635	905	1015
1.2	1010	895	800	720	650	980	1105
1.3	1030	920	815	740	660	1055	1190
1.4	1055	940	835	750	680	1135	1275
1.5	1080	960	850	760	690	1205	1360
1.6	1100	980	865	780	695	1285	1445
1.7	1120	995	880	790	710	1355	1530
1.8	1140	1010	895	800	720	1435	1610
1.9	1160	1025	905	810	725	1505	1695
2.0	1175	1040	920	830	740	1580	1780
2.5	1250	1090	965	865	775	1945	2190
3.0	1310	1150	1010	895	800	2305	2590
3.5	1360	1190	1040	925	820	2660	2990
4.0	1405	1220	1070	950	840	3010	3385
4.5	1440	1250	1090	965	860	3355	3770
5.0	1470	1280	1110	980	870	3700	4165

TABLE II.

Ultimate Extreme Fiber Stresses for Concrete Beams Reinforced with High Carbon Steel —Straight Line Theory.

By L. J. MENSCH, Mem. Am. Soc. C. E.

% tensile steel.	Ultimate Compressive Strength Obtained from Cylinder Tests.					
	2900	2400	2000	1750	1500	700
	1:1:2	1:1½:3	1:2:4	1:2½:5	1:3:7	
0.25	1040	1030	1020	1010	1010	960
0.30	1240	1230	1220	1200	1190	1080
0.35	1430	1420	1400	1380	1370	1200
0.40	1630	1610	1580	1560	1550	1330
0.45	1820	1800	1760	1740	1710	1440
0.50	2010	1970	1940	1900	1870	1540
0.55	2190	2150	2110	2060	2030	1620
0.60	2370	2330	2280	2230	2170	1700
0.65	2540	2500	2440	2370	2310	1800
0.70	2720	2650	2600	2520	2450	1800
0.75	2900	2820	2740	2660	2590	1800
0.80	3070	2990	2900	2800	2720	1800
0.85	3240	3150	3040	2930	2830	1800
0.90	3400	3300	3180	3060	2950	1800
0.95	3560	3440	3320	3200	3050	1800
1.00	3700	3570	3450	3310	3160	1800
1.10	4020	3860	3700	3520	3350	1800
1.20	4300	4120	3930	3730	3510	1800
1.30	4600	4380	4140	4000	3600	1800
1.40	4860	4610	4330	4000	3600	1800
1.50	5120	4820	4520	4000	3600	1800
1.60	5370	5050	4600	4000	3600	1800
1.70	5600	5250	4600	4000	3600	1800
1.80	5820	5450	4600	4000	3600	1800
1.90	6040	5600	4600	4000	3600	1800
2.00	6260	5750	4600	4000	3600	1800
2.25	6700	5800	4600	4000	3600	1800

TABLE III.

Copyright 1916 by Benj. E. Winslow.

Safe Extreme Fiber Stresses in Pounds per Square Inch for Double Reinforced Concrete Beams for Various Percentages of Top and Bottom Steel. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Maximum Compression on Extreme Fiber of Concrete=700 Lbs. per Sq. In. Maximum Tension in Steel Reinforcement=18000 Lbs. per Sq. In. Mixture of Concrete 1:2:4. Ratio of Modulus of Elasticity of Steel to That of Concrete=15. Ratio of Depth of Top Steel to Depth of Bottom Steel Below Top of Beam=0.10. Values for Other Steel and Concrete Stresses Are Directly Proportionate to Those Given in This Table.

Percentage of Tensile Steel	Percentage of Compressive Steel														Percentage of Tensile Steel
	0.00	0.10	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	
0.60	575	578	579	580	581	582	583	584	584	585	586	587	588	589	0.60
0.62	595	596	597	599	600	601	602	603	604	605	606	607	608	609	0.62
0.64	610	612	613	615	616	618	619	621	622	624	625	627	628	629	0.64
0.66	630	632	633	635	636	638	639	641	642	644	645	647	648	649	0.66
0.68	650	652	653	655	656	658	659	661	662	663	665	666	667	668	0.68
0.70	665	667	668	670	671	673	674	676	677	678	680	682	684	686	0.70
0.72	680	688	689	691	693	694	696	697	699	700	702	703	705	706	0.72
0.74	685	704	706	707	709	710	712	713	715	716	718	719	721	723	0.74
0.76	690	720	726	728	729	731	732	734	735	737	738	740	741	743	0.76
0.78	695	726	744	746	747	749	750	752	753	755	757	759	761	763	0.78
0.80	700	731	762	764	766	768	770	772	774	776	778	780	781	783	0.80
0.82	710	739	779	782	784	786	788	790	792	794	796	798	800	802	0.82
0.84	715	743	790	800	802	804	806	808	810	812	814	816	818	821	0.84
0.86	720	750	795	820	822	824	826	828	830	832	834	836	838	840	0.86
0.88	725	755	800	839	842	844	846	848	850	852	854	856	858	860	0.88
0.90	730	760	807	858	861	863	866	868	870	872	874	876	878	880	0.90
0.92	735	765	812	873	880	883	885	887	890	892	894	896	898	900	0.92
0.94	740	770	818	888	900	902	904	906	908	910	912	914	916	918	0.94
0.96	745	775	823	892	920	922	924	926	928	930	932	934	935	937	0.96
0.98	750	780	828	900	938	940	942	944	946	948	950	952	954	956	0.98
1.00	755	786	832	905	956	958	960	962	964	967	969	972	974	976	1.00
1.10	780	811	853	930	1010	1060	1061	1063	1065	1066	1068	1069	1071	1072	1.10
1.20	800	828	874	954	1031	1105	1155	1157	1159	1161	1163	1165	1167	1170	1.20
1.30	815	850	895	978	1058	1130	1210	1252	1254	1256	1258	1260	1262	1265	1.30
1.40	835	869	916	1006	1076	1156	1232	1310	1345	1348	1351	1354	1358	1362	1.40
1.50	850	882	935	1020	1100	1178	1255	1331	1410	1450	1452	1455	1457	1460	1.50
1.60	865	899	950	1034	1115	1196	1276	1352	1435	1511	1547	1550	1553	1555	1.60
1.70	880	913	967	1054	1130	1215	1296	1374	1455	1538	1630	1650	1652	1655	1.70
1.80	895	928	983	1064	1149	1232	1316	1394	1480	1560	1645	1710	1747	1750	1.80
1.90	905	940	995	1082	1162	1250	1332	1414	1500	1580	1665	1725	1830	1848	1.90
2.00	920	952	1008	1100	1178	1266	1350	1432	1513	1600	1680	1760	1840	1918	2.00
2.50	965	1004	1055	1152	1241	1331	1420	1510	1595	1686	1715	1855	1945	2026	2.50
3.00	1010	1048	1105	1196	1291	1385	1480	1570	1660	1750	1840	1930	2020	2108	3.00
3.50	1040	1080	1140	1234	1334	1427	1515	1615	1705	1806	1890	1990	2080	2174	3.50
4.00	1070	1115	1170	1266	1366	1464	1560	1665	1755	1852	1940	2040	2130	2230	4.00
4.50	1090	1145	1205	1295	1395	1500	1595	1700	1795	1888	1980	2080	2180	2278	4.50
5.00	1110	1160	1235	1315	1415	1525	1620	1730	1825	1924	2020	2120	2220	2318	5.00

For values above heavy line, tension in steel is equal to 18000 lbs. per square inch.

For values below heavy lines compression in concrete is equal to 700 lbs. per square inch.

Values for other steel and concrete stresses are directly proportional to those given in Tables I and III.

Table I gives the Extreme Fiber Stress for rectangular reinforced concrete beams for various mixtures of concrete and stresses in the steel for percentages of steel varying from plain concrete beams, to beams reinforced with as high as 5% of steel; all in accordance with the Building Ordinance Requirements for the City of Chicago.

In Table II are given in the headings the ultimate compressive strength of concrete as assumed by the Chicago Building Ordinance for various concrete mixtures. According to the theory of Mr. L. J. Mensch as published in the Journal of the American Concrete Institute for December, 1914, these compressive strengths, if introduced in the straight line formula do not agree with scientific tests on reinforced concrete beams to rupture. In order to make the straight line theory agree with the tests at rupture the ultimate extreme fiber stresses as given in Table II must be assumed instead of the values given in the headings.

The value 700 in the heading is for 1:2:4 cinder*-concrete. It is also valid for stone concrete a few days old. The depth of the reinforced-concrete beams is of course assumed to be the depth to the center of the steel. Tables I, II and III assume only pure tension or compression failures. Special calculations should therefore be made for bond, shear and diagonal tension.

Table III gives the Extreme Fiber Stress for rectangular Double Reinforced concrete beams, for various percentages of tensile and compressive steel; all in accordance with the Building Ordinance Requirements for the City of Chicago. See Sec. 546-567.

RECOMMENDATIONS FOR THE DESIGN OF HOOPED COLUMNS.

Concrete 1:2:4.
Rods round—½"° to 1¼"°.
Core diameter 4" less than column diameter.
As few different sizes of columns as possible.
Column diameter never less than 1/12th the story height.
Percentage of vertical steel from 1% to 7.
Percentage of hooping steel from 0.5% to 1.5%.
Maximum pitch of spiral 1/10th of core diameter, or 3".
Minimum pitch of spiral 1½".
Maximum size of spiral steel ½"°.
Minimum size of spiral steel 3/16"°.
Maximum spacing of vertical steel 9" or ⅛ circumference of column.
Minimum spacing of vertical steel 3½".
Minimum lap of vertical steel 18".
Lap of vertical steel for average core stresses less than 1000#"—25 diameters.
Lap of vertical steel for average core stresses greater than 1000#"—30 diameters.
Length of plain round stub bars in footings, 60 diameters.
Length of square twisted stub bars in footings, 40 diameters.
Stub bars embedded one-half their length in footing and one-half in column.
Length of spirals to be clear story height with one extra turn at top and bottom.
3 vertical lines of spacers for all spirals under 18" diameter.
4 vertical lines of spacers for all spirals over 18" diameter.
When columns require a large percentage of vertical steel it is often more economical to use a structural steel column and encase it in concrete. It must be remembered that the working stress of reinforcing steel is only (nxfc) while that of a structural column encased in concrete is $18000-70\frac{l}{r}$.

Metric Tables.

	Approximate Equivalent.		Accurate Equivalent.
1 inch [length]	2½	cubic centimeters	2.539
1 centimeter	0.4	inch	0.393
1 yard	1	meter	0.914
1 meter (39.37 inches)	1	yard	1.093
1 foot	30	centimeters	30.479
1 kilometer (1,000 meters)	⅝	mile	0.621
1 mile	1½	kilometers	1.600
1 gramme [weight]	15.½	grains	15.432
1 grain	0.064	gramme	0.064
1 kilogramme (1,000 grammes)	2.2	pounds avoirdupois	2.204
1 pound avoirdupois	½	kilogramme	0.453
1 ounce avoirdupois (437½ grains)	28 1/3	grammes	28.349
1 ounce troy, or apothecary (480 grains)	31	grammes	31.103
1 cubic centimeter [bulk]	1.06	cubic inch	1.060
1 cubic inch	16 1/3	cubic centimeters	16.386
1 liter (1,000 cubic centimeters)	1	U. S. standard quart	0.946
1 United States quart	1	liter	1.057
1 fluid ounce	29½	cubic centimeters	29.570
1 hectare (10,000 square meters) [surface]	2½	acres	2.471
1 acre	0.4	hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

Diameter of a circle × 3.1416 = circumference.
Radius of a circle × 6.283185 = circumference.
Square of the diameter of a circle × 0.7854 = area.
Square of the circumference of a circle × 0.07958 = area.
Half the circumference of a circle × half its diameter = area.
Circumference of a circle × 0.159155 = radius.
Square root of the area of a circle × 0.56419 = radius.
Circumference of a circle × 0.31831 = diameter.
Square root of the area of a circle × 1.12838 = diameter.
Diameter of a circle × 0.86 = side of inscribed equilateral triangle.
Diameter of a circle × 0.7071 = side of an inscribed square.
Circumference of a circle × 0.225 = side of an inscribed square.
Circumference of a circle × 0.282 = side of an equal square.
Diameter of a circle × 0.8862 = side of an equal square.
Base of a triangle × ½ the altitude = area.
Multiplying both diameters and .7854 together = area of an ellipse.
Surface of sphere × ⅙ of its diameter = solidity.
Circumference of a sphere × its diameter = surface.
Square of the diameter of a sphere × 3.1416 = surface.
Square of the circumference of a sphere × 0.3183 = surface.
Cube of the diameter of a sphere × 0.5236 = solidity.
Cube of the radius of a sphere × 4.1888 = solidity.
Cube of the circumference of a sphere × 0.016887 = solidity.
Square root of the surface of a sphere × 0.56419 = diameter.
Square root of the surface of a sphere × 1.772454 = circumference.
Cube root of the solidity of a sphere × 1.2407 = diameter.
Cube root of the solidity of a sphere × 3.8978 = circumference.
Radius of a sphere × 1.1547 = side of inscribed cube.
Square root of (⅓ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × ⅓ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × ½ the sum of its parallel sides = area.

Square root of ($\frac{1}{8}$ of the square of) the diameter of a sphere = side of inscribed cube.

Area of its base × $\frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.

Area of one of its sides × 6 = surface of a cube.

Altitude of trapezoid × $\frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1 0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

Capacity of Bins and Boxes.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and $8\frac{2}{5}$ inches deep will contain one bushel; 16 by $8\frac{2}{5}$ inches and 8 inches deep will contain half a bushel; 8 by $8\frac{2}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and $4\frac{1}{5}$ inches deep will contain one gallon; 7 by 4 inches and $4\frac{1}{4}$ inches deep will contain half a gallon; 4 inches square and $4\frac{1}{5}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length. 28 inches; volume, 7,680 cubic inches.

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	.43	65	28.15	130	56.31	195	84 47	260	112.62	350	151 61
5	2 16	70	30.32	135	58.48	200	86 63	265	114 79	360	155 94
10	4 33	75	32 48	140	60.64	205	88 80	270	116.96	370	160 27
15	6 49	80	34 65	145	62 81	210	90 96	275	119.12	380	164 61
20	8.66	85	36.82	150	64.97	215	93 14	280	121.29	390	168 94
25	10.82	90	38 98	155	67.14	220	95.30	285	123.45	400	173 27
30	12 99	95	41.15	160	69.31	225	97 49	290	125 62	500	216 58
35	15 16	100	43 31	165	71 47	230	99 63	295	127.78	600	259.90
40	17.32	105	45.48	170	73 64	235	101 79	300	129.95	700	303 22
45	19 49	110	47 64	175	75.80	240	103 96	310	134.28	800	346 54
50	21.65	115	49.81	180	77 97	245	106 13	320	138 62	900	389 86
55	23 82	120	51.98	185	80.14	250	108 29	330	142 95	1,000	433 18
60	25 99	125	54 15	190	82.30	255	110 46	340	147 28		

For an exhaustive discussion of live loads in buildings send for "Report of Building Code Committee," Nov. 1, 1924, U. S. Dept. of Commerce entitled "Minimum Live Loads Allowable for Use in Design of Buildings." This report gives tables tabulating almost every kind of building occupancy.

Weights of Materials.

Dry Woods.

	Lbs. Board ft.	Lbs. Cubic ft.		Lbs. Board ft.	Lbs. Cubic ft
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American white	3.9	47.	Larch	3.	35.
Birch	3.9	45.	Lignum Vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.4	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.4	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials—Stacked.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed	150	Glass—window	157
" common	125	Granite	170
" soft	100	Lime—quick	53
Cement—Portland	100	Plaster of Paris	70
Cement—Rosendale	56	Sand	90-106
Cinders—dry	72	Sandstone	151
Cinders—packed	90	Shale	162
Earth—dry, shaken	82- 92	Slate	175
Earth—rammed	92-100	Trap rock	187

Masonry.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed or paving	140	Granite	160
Brick—hard, common	120	Mortar and plaster	120
Brick—soft	100	Rubble—limestone, common	140
Brick—hollow	90	Rubble—limestone, cut face	150
Concrete—stone	150	Rubble—sandstone, common	140
Concrete—cinder	96	Rubble—sandstone, cut face	150

Standard Load-Bearing Wall Tile.

End construction:	Number of cells	Weight, each lbs.	Side construction:	Number of cells	Weight, each lbs.
3¾ by 12 by 12	3	20	3¾ by 5 by 12	1	9
6 by 12 by 12	4	30	8 by 5 by 12	2	16
8 by 12 by 12	6	36	8 by 5 by 12 ("L" shaped)	3	16
10 by 12 by 12	6	42	8 by 6¼ by 12 ("T" shaped)	4	16
12 by 12 by 12	6	48	8 by 7¾ by 12 (square)	6	24
			8 by 10¼ by 12 ("H" shaped)	7	32

Standard Partition Tile.

	Number of cells	Weight, each lbs.		Number of cells	Weight, each lbs.
3 by 12 by 12	3	15	8 by 12 by 12	4	30
4 by 12 by 12	3	16	10 by 12 by 12	4	36
6 by 12 by 12	3	22	12 by 12 by 12	4	40

Standard Split Furring Tile.

	Number of cells	Weight, each lbs.
2 by 12 by 12	2	9

Standard Book Tile.

	Lbs. per sq. ft.
3 by 12 by 18 to 24	18

Building Materials—In Construction.

Roofing.

	Lbs. per square ft.		Lbs. per square ft
Copper—sheet	0.75	to 1.25	Shingles—wood 18"	2
Felt and gravel	8	to 10	Shingles—wood 16"	2
Iron—corrugated	1	to 3.75	Slate—average	10
Iron—galvanized	1	to 3	Tile—fancy, laid in mortar	25 to 30
Iron—sheet, black painted	1.5		Tile—plain, average	12
Ready composition roofing	1	to 1.5	Tin and paint	1
Sheet lead	4	to 8	Zinc	1 to 2

Floors.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Flat arches (tile) 3" thick	17	Flat arches (tile) 12" thick	39
" " " 4" "	18	" " " 14" "	43
" " " 6" "	25	" " " 16" "	49
" " " 8" "	31	Book tile 2" thick	15
" " " 10" "	35	" " 3" "	17
Brick arches 4" thick and concrete	70	Beam tile	15

Table for Weights of Yellow Pine Joists, Studs and Rafters on the Assumption That One Board Foot of Y. P. Weighs 2.8 Pounds.

Spacing	Size	Weight per Sq. Foot	Size	Weight Per Sq. Foot	Size	Weight
12"	2"x4"	1.87	2"x6"	2.8	2"x8"	3.74
14"	"	1.60	"	2.4	"	3.20
16"	"	1.40	"	2.1	"	2.80
18"	"	1.25	"	1.87	"	2.50
20"	"	1.12	"	1.68	"	2.24
22"	"	1.02	"	1.53	"	2.04
12"	2"x10"	4.68	2"x12"	5.61	2"x14"	6.55
14"	"	4.00	"	4.80	"	5.60
16"	"	3.50	"	4.20	"	4.90
18"	"	3.13	"	3.75	"	4.38
20"	"	2.80	"	3.36	"	3.92
22"	"	2.55	"	3.06	"	3.57

Partitions.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Gypsum partition blocks 3" thick....	10	Partition tile 3" thick.....	17
" " " 4" "	12	" " 4" "	18
" " " 5" "	14	" " 6" "	25
" " " 6" "	16	" " 8" "	31
Plaster on brick, tile or concrete...	5	" " 10" "	35

Ceiling.

	Lbs. per sq. ft.
Lath and plaster 2 coats.....	9
Lath and plaster 3 coats.....	10
Suspended ceiling	10

Sheathing, Flooring, etc.

	Lbs. per sq. ft
Pine, Hemlock, Spruce, Poplar, Redwood, per inch thick.....	3
Chestnut, Maple	4

Weight per Square Foot of Sheet Lead.

1/62 inch thick.....2	lbs.	1/10 inch thick..... 7	lbs
3/64 " " 2½	"	1/8 " " 8	"
1/25 " " 3	"	5/32 " " 10	"
1/16 " " 4	"	3/16 " " 12	"
1/14 " " 5	"	7/32 " " 14	"
1/12 " " 6	"	¼ " " 16	"

Miscellaneous Items.

While the following items vary considerably in weight, the values given below are fair averages and may be used for preliminary computations.

	Lbs. per sq. ft.
Iron stair construction	50
Concrete stair construction	150
Wood stair construction	20
Sidewalk lights in concrete.....	30
Reinforcement of concrete	6
Steel joists per sq. ft. of floor.....	6
Steel girders per sq. ft. of floor.....	4

Contents of Storage Warehouses.

Material.	Weight per Cu. ft.	Allowable Height of Pile in ft.
Groceries Etc.		
Beans—in bags	40	8
Canned goods—cases	58	6
Coffee—roasted, in bags...	33	8
Coffee—green, in bags....	39	8
Flour—in barrels	40	5
Molasses—in barrels.....	48	5
Rice—in bags	58	6
Sal Soda—in barrels.....	46	5
Salt—in bags	70	5
Soap powder—in cases.....	38	8
Starch—in barrels	25	6
Sugar—in barrels	43	5
Sugar—in cases	51	6
Tea—in chests	25	8
Wines and Liquors, in bbls.	38	6
Dry Goods, Cotton, Wool, Etc.		
Burlap—in bales	43	6
Coir Yarn, in bales.....	33	8
Cotton — in bales, compressed	18	8
Cotton Bleached Goods — in cases	28	8
Cotton Flannel—in cases..	12	8
Cotton Sheeting—in cases.	23	8
Cotton Yarn—in cases....	25	8
Excelsior—compressed	19	8
Hemp—Manila, compressed	30	8
Linen Goods—in cases....	30	8
Wool—in bales, not compressed	13	8
Wool—worsteds, in cases..	27	8
Hardware, Etc.		
Sheet tin—in boxes.....	278	2
Wire—insulated copper, in coils	63	5
Wire—galvanized iron, in coils	74	4.5
Wire—magnet, on spools..	75	6
Drugs, Paints, Oils, Etc.		
Glycerine—in cases.....	52	6
Linseed oil—in bbls.....	36	6
Logwood extract—in boxes	70	5
Rosin—in bbls.....	48	6
Shellac—gum	38	6
Soda — Caustic, in iron drums	88	3.33
Soda—Silicate, in bbls....	53	6
Sulphuric Acid	60	1.66
White Lead Paste—in cans	174	3.5
White Lead—dry	86	4.75
Red Lead and Litharge Putty—dry	132	3.75
Miscellaneous.		
Glass and Chinaware — in cases	40	8
Hides and Leather — in bales	20	8
Paper — newspaper and strawboard	35	6
Paper—writing and calendared	60	6
Rope—in coils	32	6

NOMENCLATURE OF DRAWINGS

We present in the following pages a collation of symbols for plan nomenclature, which we hope will be the means of bringing about a more uniform practice. In addition to the convenience, which will result from uniform practice to those compelled to examine, estimate from or execute plans from different offices; it will be found that the proficiency of draftsmen will not be so seriously affected on changing from office to office if practice becomes uniform.

General symbols presented have been collated from various sources. To assist memory those symbols have been selected which are suggestive in their make up.

For illustration all lines indicating water pipes have a periodic double indentation suggestive of a "w"; gas lines a periodic embryo "G", etc.

Lighting symbols are those adopted by the American Institute of Architects and the National Electrical Contractors' Association, except that 50 watts is taken as the standard for one light unit instead of 16 c. p.

Structural iron standard symbols; the Osborn systems are so generally understood and used that it hardly seems necessary to publish same. (See Cambria pocket book, 1906 edition, p. 309.)

GENERAL SYMBOLS

	In color system use
Earth	Black
Cinders	Green
Concrete	Brown
Stone	Blue
Brick	Red
Structural tile	Brown
Composition wall blocks	Blue
Architectural terra cotta	Brown
Plaster	Blue
Structural iron	Green
Sheet metal	Green
Floor tile, tile and mosaics	Brown
Marble (in elevation)	Blue
Marble (in section)	Blue
Terrazo	Black
Wood in section (soft wood) with grain / hard wood	Yellow / Brown
Wood in section (soft wood) across grain / hard wood	Yellow / Brown
Cork	Brown
Canvas	Blue
Rubber	

Ad Dressed ashlar

R Rough ashlar

Ar Rock faced ashlar

d Axe stone dressed

A Ashlar

7 Not described, small numeral refers to schedule of stone finishes

7 SIZE HERE — Column. Small numeral indicates No. of particular column

D 25 — Door: Small numeral indicates No. of particular door

W 50 — Window. Small numeral indicates No. of particular window

N 3 — Indicates designating No. of a room or space

+7-6 — Elevation of points, small numerals indicate elevation above zero point.

PIPING SYMBOLS

	In color system
Cold water	Blue
Hot water	Red
Hot water return	Red
Filtered or drinking water	Blue
Gas piping	Green
Air piping	Green
Compressed air piping	Green
Vacuum cleaning	Green

SEWERAGE AND DRAINAGE

Iron sewer pipe	Green
Sanitary iron sewer pipe	Green
Tile sewer	Red
Sanitary Tile Sewer	Red
Drainage tile	Brown
S.P. Soil pipe	Green
W.P. Waste pipe	Green
D.S. Down spout	Green
V.R. Vent riser	Green
Floor drain	Brown
2 Bracket: Prefix with "F" if for fuel	Blue
3 Ceiling. Prefix with "F" if for fuel	Blue
7 Floor outlet. Prefix with "F" if for fuel	Blue
4/2 Combined gas and electric, lower figure indicates No. of gas tips, upper figure [illegible]	Blue

STANDARD SYMBOLS FOR WIRING PLAN S

As recommended and adopted by The Association of Electragists, International, The American Institute of Architects, and the American Institute of Electrical Engineers and approved by The American Engineering Standards Committee on March 6, 1924.

- Ceiling Outlet
- Ceiling Outlet (Gas and Electric)
- Ceiling Lamp Receptacle — Specification to Describe Type Such as Key, Keyless or Pull Chain
- Ceiling Outlet for Extensions
- Ceiling Fan Outlet
- Pull Switch
- Drop Cord
- Wall Bracket
- Wall Bracket (Gas and Electric)
- Wall Outlet for Extensions
- Wall Fan Outlet
- Wall Lamp Receptacle — Specification to Describe Type Such as Key, Keyless or Pull Chain
- Single Convenience Outlet
- Double Convenience Outlet
- Junction Box
- Special Purpose Outlet — Lighting, Heating and Power as Described in Specification
- Special Purpose Outlet — Lighting, Heating and Power as Described in Specification
- Special Purpose Outlet — Lighting, Heating and Power as Described in Specification
- Exit Light
- Floor Outlet
- Floor Elbow
- Floor Tee
- Local Switch — Single Pole
- Local Switch — Double Pole
- Local Switch — 3 Way
- Local Switch — 4 Way
- Automatic Door Switch
- Key Push Button Switch
- Electrolier Switch
- Push Button Switch and Pilot
- Remote Control Push Button Switch
- Push Button
- Buzzer
- Bell
- Annunciator
- Interior Telephone
- Public Telephone
- Clock (Secondary)
- Clock (Master)
- Time Stamp
- Electric Door Opener
- Local Fire Alarm Gong
- City Fire Alarm Station
- Local Fire Alarm Station
- Fire Alarm Central Station
- Speaking Tube
- Nurse's Signal Plug
- Maid's Plug
- Horn Outlet
- District Messenger Call
- Watchman Station
- Watchman Central Station Detector
- Public Telephone — P B X Switchboard
- Interconnection Telephone Central Switchboard
- Interconnection Cabinet
- Telephone Cabinet
- Telegraph Cabinet
- Special Outlet for Signal System — As described in specification
- Battery
- Tank Switch
- Motor
- Motor Controller
- Lighting Panel
- Power Panel
- Heating Panel
- Pull Box
- Cable Supporting Box
- Meter
- Transformer
- Branch Circuit, Run Concealed Under Floor Above
- Branch Circuit, Run Exposed
- Branch Circuit, Run Concealed Under Floor
- Signal Wires in Conduit — Concealed Under Floor
- Signal Wires in Conduit — Concealed Under Floor Above
- Tap Circuits Indicated by 2 Number 14 Conductors in ½" Conduit
- 3 Number 14 Conductors in ½" Conduit
- 4 Number 14 Conductors in ½" Conduit Unless Marked
- 5 Number 14 Conductors in ¾" Conduit
- 6 Number 14 Conductors in 1" Conduit Unless Marked ¾"
- 7 Number 14 Conductors in 1" Conduit
- 8 Number 14 Conductors in 1¼" Conduit
- Feeder Run Concealed Under Floor Above
- Feeder Run Exposed
- Feeder Run Concealed Under Floor
- Pole Line

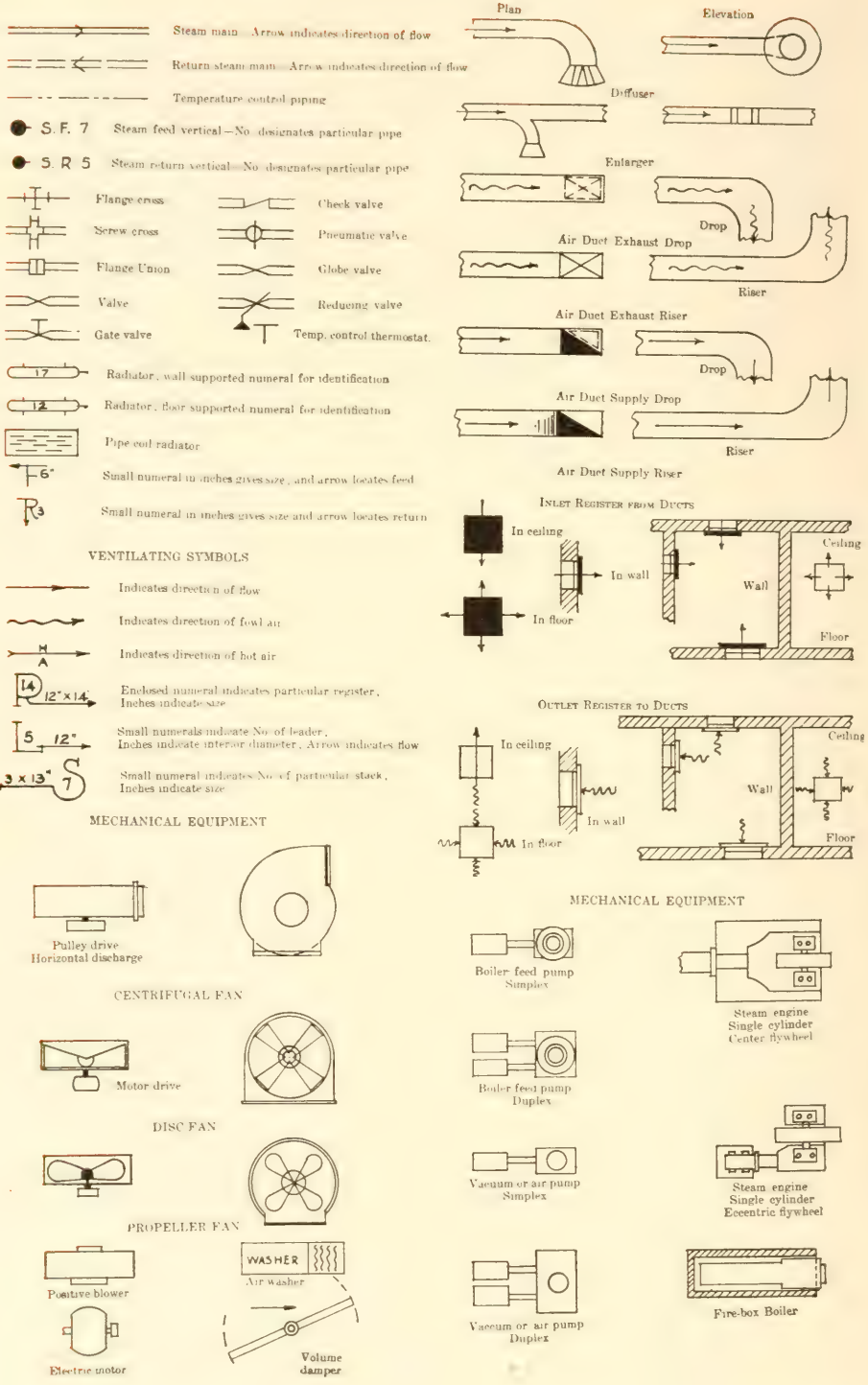
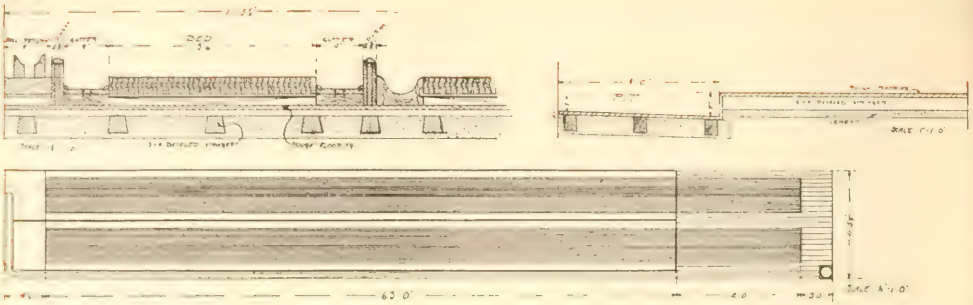

Steam main—Arrow indicates direction of flow
Return steam main—Arrow indicates direction of flow
Temperature control piping
S. F. 7
Steam feed vertical—No. designates particular pipe
S. R 5
Steam return vertical—No. designates particular pipe
Flange cross
Screw cross
Flange Union
Valve
Gate valve
Check valve
Pneumatic valve
Globe valve
Reducing valve
Temp. control thermostat
17
Radiator, wall supported numeral for identification
12
Radiator, floor supported numeral for identification
Pipe coil radiator
6"
Small numeral in inches gives size, and arrow locates feed
R3
Small numeral in inches gives size and arrow locates return
VENTILATING SYMBOLS
Indicates direction of flow
Indicates direction of fowl air
H
A
Indicates direction of hot air
14
12" x 14"
Enclosed numeral indicates particular register, Inches indicate size
5
12"
Small numerals indicate No. of leader, Inches indicate interior diameter. Arrow indicates flow
3 x 13"
7
Small numeral indicates No. of particular stack, Inches indicate size
MECHANICAL EQUIPMENT
Pulley drive
Horizontal discharge
CENTRIFUGAL FAN
Motor drive
DISC FAN
PROPELLER FAN
Positive blower
Electric motor
WASHER
Air washer
Volume damper
Plan
Elevation
Diffuser
Enlarger
Drop
Air Duct Exhaust Drop
Riser
Air Duct Exhaust Riser
Drop
Air Duct Supply Drop
Riser
Air Duct Supply Riser
INLET REGISTER FROM DUCTS
In ceiling
In wall
In floor
Ceiling
Wall
Floor
OUTLET REGISTER TO DUCTS
In ceiling
In wall
In floor
Ceiling
Wall
Floor
MECHANICAL EQUIPMENT
Boiler feed pump
Simplex
Boiler feed pump
Duplex
Vacuum or air pump
Simplex
Vacuum or air pump
Duplex
Steam engine
Single cylinder
Center flywheel
Steam engine
Single cylinder
Eccentric flywheel
Fire-box Boiler

TABLE OF TREADS AND RISERS

No. of Treads.	6 Inch Rise. ft. in.	6¼ Inch Rise ft. in.	6½ Inch Rise. ft. in.	6¾ Inch Rise. ft. in.	7 Inch Rise. ft. in.	7⅛ Inch Rise. ft. in.	7¼ Inch Rise. ft. in.	7⅜ Inch Rise. ft. in	7½ Inch Rise. ft. in.	7⅝ Inch Rise. ft. in.	7¾ Inch Rise. ft. in.	7⅞ Inch Rise. ft. in.	8 Inch Rise. ft. in.	8¼ Inch Rise. ft. in.	8½ Inch Rise. ft. in.	9 Inch Rise. ft. in	9½ Inch Rise. ft. in.	10 Inch Rise. ft. in.	10½ Inch Rise. ft. in.	11 Inch Rise. ft. in.	13 Inch Rise. ft. in.	14 Inch Rise. ft. in.
1	6	6¼	6½	6¾	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8¼	8½	9	9½	10	10½	11	1 1	1 2
2	1 0	1 0½	1 1	1 1½	1 2	1 2¼	1 2½	1 2¾	1 3	1 3¼	1 3½	1 3¾	1 4	1 4½	1 5	1 6	1 7	1 8	1 9	1 10	2 2	2 4
	1 6	1 6¾	1 7½	1 8¼	1 9	1 9⅜	1 9¾	1 10⅛	1 10½	1 10⅞	1 11¼	1 11⅝	2 0	2 0¾	2 1½	2 3	2 4½	2 6	2 7½	2 9	3 3	3 6
.	2 0	2 1	2 2	2 3	2 4	2 4½	2 5	2 5½	2 6	2 6½	2 7	2 7½	2 8	2 9	2 10	3 0	3 2	3 4	3 6	3 8	4 4	4 8
5	2 6	2 7¼	2 8½	2 9¾	2 11	2 11⅝	3 0¼	3 0⅞	3 1½	3 2⅛	3 2¾	3 3⅜	3 4	3 5¼	3 6½	3 9	3 11½	4 2	4 4½	4 7	5 5	5 10
6	3 0	3 1½	3 3	3 4½	3 6	3 6¾	3 7½	3 8¼	3 9	3 9¾	3 10½	3 11¼	4 0	4 1½	4 3	4 6	4 9	5 0	5 3	5 6	6 6	7 0
7	3 6	3 7¾	3 9½	3 11¼	4 1	4 1⅞	4 2¾	4 3⅝	4 4½	4 5⅜	4 6¼	4 7⅛	4 8	4 9¾	4 11½	5 3	5 6½	5 10	6 1½	6 5	7 7	8 2
8	4 0	4 2	4 4	4 6	4 8	4 9	4 10	4 11	5 0	5 1	5 2	5 3	5 4	5 6	5 8	6 0	6 4	6 8	7 0	7 4	8 8	9 4
9	4 6	4 8¼	4 10½	5 0¾	5 3	5 4⅛	5 5¼	5 6⅜	5 7½	5 8⅝	5 9¾	5 10⅞	6 0	6 2¼	6 4½	6 9	7 1½	7 6	7 10½	8 3	9 9	10 6
10	5 0	5 2½	5 5	5 7½	5 10	5 11¼	6 0½	6 1¾	6 3	6 4¼	6 5½	6 6¾	6 8	6 10½	7 1	7 6	7 11	8 4	8 9	9 2	10 10	11 8
11	5 6	5 8¾	5 11½	6 2¼	6 5	6 6⅜	6 7¾	6 9⅛	6 10½	6 11⅞	7 1¼	7 2⅝	7 4	7 6¾	7 9½	8 3	8 8½	9 2	9 7½	10 1	11 11	12 10
12	6 0	6 3	6 6	6 9	7 0	7 1½	7 3	7 4½	7 6	7 7½	7 9	7 10½	8 0	8 3	8 6	9 0	9 6	10 0	10 6	11 0	13 0	14 0
13	6 6	6 9¼	7 0½	7 3¾	7 7	7 8⅝	7 10¼	7 11⅞	8 1½	8 3⅛	8 4¾	8 6⅜	8 8	8 11¼	9 2½	9 9	10 3½	10 10	11 4½	11 11	14 1	15 2
14	7 0	7 3½	7 7	7 10½	8 2	8 3¾	8 5½	8 7¼	8 9	8 10¾	9 0½	9 2¼	9 4	9 7½	9 11	10 6	11 1	11 8	12 3	12 10	15 2	16 4
15	7 6	7 9¾	8 1½	8 5¼	8 9	8 10⅞	9 0¾	9 2⅝	9 4½	9 6⅜	9 8¼	9 10⅛	10 0	10 3¾	10 7½	11 3	11 10½	12 6	13 1½	13 9	16 3	17 6
16	8 0	8 4	8 8	9 0	9 4	9 6	9 8	9 10	10 0	10 2	10 4	10 6	10 8	11 0	11 4	12 0	12 8	13 4	14 0	14 8	17 4	18 8
17	8 6	8 10¼	9 2½	9 6¾	9 11	10 1⅛	10 3¼	10 5⅜	10 7½	10 9⅝	10 11¾	11 1⅞	11 4	11 8¼	12 0½	12 9	13 5½	14 2	14 10½	15 7	18 5	19 10
18	9 0	9 4½	9 9	10 1½	10 6	10 8¼	10 10½	11 0¾	11 3	11 5¼	11 7½	11 9¾	12 0	12 4½	12 9	13 6	14 3	15 0	15 9	16 6	19 6	21 0
19	9 6	9 10¾	10 3½	10 8¼	11 1	11 3⅜	11 5¾	11 8⅛	11 10½	12 0⅞	12 3¼	12 5⅝	12 8	13 0¾	13 5½	14 3	15 0½	15 10	16 7½	17 5	20 7	22 2
20	10 0	10 5	10 10	11 3	11 8	11 10½	12 1	12 3½	12 6	12 8½	12 11	13 1½	13 4	13 9	14 2	15 0	15 10	16 8	17 6	18 4	21 8	23 4
21	10 6	10 11¼	11 4½	11 9¾	12 3	12 5⅝	12 8¼	12 10⅞	13 1½	13 4⅛	13 6¾	13 9⅜	14 0	14 5¼	14 10½	15 9	16 7½	17 6	18 4½	19 3	22 9	24 6
22	11 0	11 5½	11 11	12 4½	12 10	13 0¾	13 3½	13 6¼	13 9	13 11¾	14 2½	14 5¼	14 8	15 1½	15 7	16 6	17 5	18 4	19 3	20 2	23 10	25 8
23	11 6	11 11¾	12 5½	12 11¼	13 5	13 7⅞	13 10¾	14 1⅝	14 4½	14 7⅜	14 10¼	15 1⅛	15 4	15 9¾	16 3½	17 3	18 2½	19 2	20 1½	21 1	24 11	26 10
24	12 0	12 6	13 0	13 6	14 0	14 3	14 6	14 9	15 0	15 3	15 6	15 9	16 0	16 6	17 0	18 0	19 0	20 0	21 0	22 0	26 0	28 0
25	12 6	13 0¼	13 6½	14 0¾	14 7	14 10⅛	15 1¼	15 4⅜	15 7½	15 10⅝	16 1¾	16 4⅞	16 8	17 2¼	17 8½	18 9	19 9½	20 10	21 10½	22 11	27 1	29 2
26	13 0	13 6½	14 1	14 7½	15 2	15 5¼	15 8½	15 11¾	16 3	16 6¼	16 9½	17 0¾	17 4	17 10½	18 5	19 6	20 7	21 8	22 9	23 10	28 2	30 4
27	13 6	14 0¾	14 7½	15 2¼	15 9	16 0⅜	16 3¾	16 7⅛	16 10½	17 1⅞	17 5¼	17 8⅝	18 0	18 6¾	19 1½	20 3	21 4½	22 6	23 7½	24 9	29 3	31 6
28	14 0	14 7	15 2	15 9	16 4	16 7½	16 11	17 2½	17 6	17 9½	18 1	18 4½	18 8	19 3	19 10	21 0	22 2	23 4	24 6	25 8	30 4	32 8
29	14 6	15 1¼	15 8½	16 3¾	16 11	17 2⅝	17 6¼	17 9⅞	18 1½	18 5⅛	18 8¾	19 0⅜	19 4	19 11¼	20 6½	21 9	22 11½	24 2	25 4½	26 7	31 5	33 10
30	15 0	15 7½	16 3	16 10½	17 6	17 9¾	18 1½	18 5¼	18 9	19 0¾	19 4½	19 8¼	20 0	20 7½	21 3	22 6	23 9	25 0	26 3	27 6	32 6	35 0

RULE FOR CACULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISERS OF STAIRS.

Subtract the width of tread from 25 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then 25 — 10 = 15 ÷ 2 = 7½ in., the height of riser proportionate to a 10-inch tread. This is exclusive of nosings.



SPACE OCCUPIED BY AUTOMOBILES.

Touring Cars.

Length, 13 ft. 6 in. to 20 ft.
Height, 7 ft. 3 in.
Width, 6 ft. 0 in.
Smallest practical door, 8 ft. 0 in. high by 8 ft. 0 in. wide. Alley door should be not less than 11 ft. 4 in. and should be set not less than 22 ft. from opposite side.

Heavy Trucks.

Length, 15 ft. to 26 ft.
Width, 6 ft. 0 in.
Height, 10 ft. 0 in.
Width on floor between wheel pockets, 48 in. Length of wheel pocket, 34 in.
Smallest practical door, 9 ft. 0 in. wide by 11 ft. 0 in. high; for largest trucks, 13 ft. 6 in. high.
Doors to alley should not be less than 12 ft. wide and should be set not less than 28 ft. from opposite side of alley.

Moving Vans.

Length, 13 ft. to 16 ft. 6 in.
Width, 7 ft. to 8 ft. 2 in.
Height, 10 ft. to 12 ft.
Smallest practical door 10 ft. 0 in. wide by 13 ft. 6 in. high.

CLEARANCE UNDER OLD ELEVATED RAILWAY STRUCTURES AND TROLLEY WIRES, 12 FT. 0 IN.

Clearance required by the city for steam roads, 13 ft. 6 in.

Architects will be perfectly safe in making the maximum limit of door heights for any sort of vehicle 13 ft. 6 in., standard subway height, as no vehicle can be used commercially on the streets of Chicago that will not clear steam road viaducts. They might go around elevated viaducts, but they can not go around steam road viaducts and there is a probability that any future elevated viaducts would be raised to the city standard height of 13 ft. 6 in.

FURNITURE DIMENSIONS.

FILE 8270

Chairs—Height of seat, 18″; depth of seat, 19″; top of back, 38″; arms, 9″ above seat.

Lounge—6′ long, 30″ wide.

Tables—Writing, height, 2′-5″; sideboards, height, 3′-0″; general height, 2′-6″.

Note—The smallest size practical for knee holes, 2′ high by 1′-8″ wide.

Beds—Single, width, 3′ to 4′; ¾ bed, width, 4′; double bed, width, 4′-6″ to 5′-0″, length 6′-6″ to 6′-8″; standard double bed, 4′-6″ x 6′-6″; footboards, 2′-6″ to 3′-6″ high; headboards, 5′ to 6′-6″.

Bureaus—Common, width, 3′-5″ or 4′; depth, 1′-6″ or 1′-8″; height, 2′-6″ or 3′.

Commodes—Top, 1′-6″ square and 2′-6″ high.

Chiffoniers—3′ wide, 1′-8″ deep, 4′-4″ high.

Cheval Glasses—Height, 6′-4″ or 5′-0″ or 5′-2″; width, 3′-2″ or 2′-6″ or 1′-8″.

Washstands—Length, 3′-0″; width, 1′-6″; height, 2′-7″.

Wardrobes—Length, 4′-6″—3′-0″; depth, 2′-0″—1′-5″; height, 8′-0″.

Sideboards—Length, 5′ to 6′; depth, 2′-2″.

Pianos—Upright, length, 4′-10″ to 5′-6″; height, 4′-4″ to 4′-9″; depth, 2′-4″. Square, length, 6′-8″; depth, 3′-4″.

Billiard Tables—4′-8″, 4½″ x 9, 5′ x 10. Must have 16′ x 20′ space.

Wardrobe Shelves—5′-10″ high.

Coat Hooks—5′-6″ high.

Flour Barrel—28″ to 30″ high and 20″ to 21″ dia.

DATA ON BUILDINGS WITH SIDINGS.

Clearance from face of building to center of track, 7′-0″.

Height of loading decks:
For shipping, 4′-0″.
For receiving, 3′-0″.

Clearance from center of track to edges of loading decks:
Upper edge, 7′-0″.
Lower edge, 5′-0″.

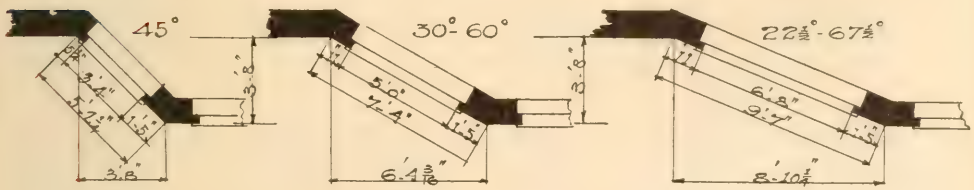
FILE 72

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
5	10	7′ 4″	11′ 6″	12′ 6″
7	11	8′	11′ 6″	12′ 6″
8	12	8′	12′ 6″	12′ 6″
10	13	8′ 7″	12′ 6″	12′ 6″
11	14	9′ 3″	12′ 6″	12′ 6″
13	16	10′ 5″	12′ 6″	12′ 6″
14	17	11′	14′ 8″	17′
16	18	11′ 7″	14′ 8″	17′
17	19	12′ 2″	14′ 8″	17′
19	20	12′ 9″	14′ 8″	17′

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
20	21	12′ 9″	15′ 6″	17′
22	22	13′ 4″	15′ 6″	17′
23	23	13′ 6″	15′ 6″	17′
25	24	14′	15′ 6″	17′
26	25	14′ 6″	15′ 6″	17′
28	26	14′ 6″	15′ 6″	17′
29	27	14′ 6″	16′ 4″	17′ 6″
31	28	15′	16′ 4″	17′ 6″
32	29	15′ 6″	16′ 4″	17′ 6″
34	30	15′ 6″	17′	17′ 6″

Add 40″ more from Front Line of Case for Keydesk Pedals and Seat.

TABLE SHOWING THE LENGTH OF SIDES OF BAYS ANGLE BEING 45, 30-60 AND 22½-67½ DEGREES.



Examples.

Angle of 45 Degrees.

1	ft.	6	in.	by	1	ft.	6	in.	2	ft.	1 7/16	in.	2	ft.	10	in.	by	2	ft.	10	in.	4	ft.	0 1/16	in.
1	"	7	"	"	1	"	7	"	2	"	2 7/8	"	2	"	11	"	"	2	"	11	"	4	"	1 1/2	"
1	"	8	"	"	1	"	8	"	2	"	4 1/4	"	3	"	0	"	"	3	"	0	"	4	"	2 1/16	"
1	"	9	"	"	1	"	9	"	2	"	5 1/16	"	3	"	1	"	"	3	"	1	"	4	"	4 1/16	"
1	"	10	"	"	1	"	10	"	2	"	7 1/8	"	3	"	2	"	"	3	"	2	"	4	"	5 3/4	"
1	"	11	"	"	1	"	11	"	2	"	8 1/2	"	3	"	3	"	"	3	"	3	"	4	"	7 1/8	"
2	"	0	"	"	2	"	0	"	2	"	9 1/16	"	3	"	4	"	"	3	"	4	"	4	"	8 1/16	"
2	"	1	"	"	2	"	1	"	2	"	11 3/8	"	3	"	5	"	"	3	"	5	"	4	"	10	"
2	"	2	"	"	2	"	2	"	3	"	0 3/4	"	3	"	6	"	"	3	"	6	"	4	"	11 3/8	"
2	"	3	"	"	2	"	3	"	3	"	2 1/16	"	3	"	7	"	"	3	"	7	"	5	"	1 1/16	"
2	"	4	"	"	2	"	4	"	3	"	3 5/8	"	3	"	8	"	"	3	"	8	"	5	"	2 1/4	"
2	"	5	"	"	2	"	5	"	3	"	5	"	3	"	9	"	"	3	"	9	"	5	"	3 5/8	"
2	"	6	"	"	2	"	6	"	3	"	6 7/16	"	3	"	10	"	"	3	"	10	"	5	"	5 1/16	"
2	"	7	"	"	2	"	7	"	3	"	7 7/8	"	3	"	11	"	"	3	"	11	"	5	"	6 1/2	"
2	"	8	"	"	2	"	8	"	3	"	9 1/4	"	4	"	0	"	"	4	"	0	"	5	"	7 7/8	"
2	"	9	"	"	2	"	9	"	3	"	10 11/16	"													

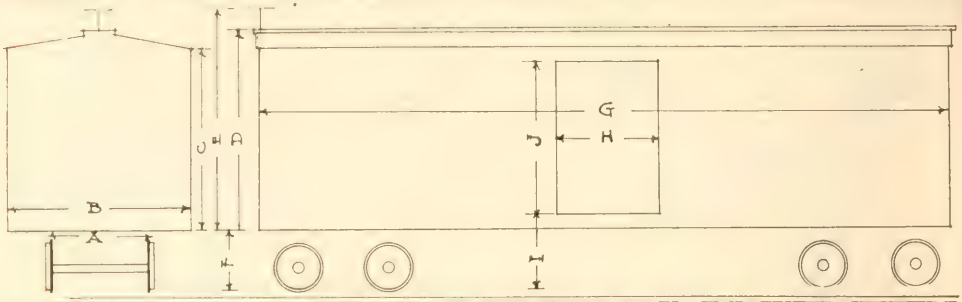
Angle of 30-60 Degrees.

1	ft.	6	in.	by	2	ft.	7 3/16	in.	3	ft.	0	in.	2	ft.	10	in.	by	4	ft.	10 7/8	in.	5	ft.	8	in.
1	"	7	"	"	2	"	8 11/16	"	3	"	2	"	2	"	11	"	"	5	"	0 5/8	"	5	"	10	"
1	"	8	"	"	2	"	10 5/8	"	3	"	4	"	3	"	0	"	"	5	"	2 3/8	"	6	"	0	"
1	"	9	"	"	3	"	0 3/8	"	3	"	6	"	3	"	1	"	"	5	"	4 1/16	"	6	"	2	"
1	"	10	"	"	3	"	2 1/8	"	3	"	8	"	3	"	2	"	"	5	"	5 1/16	"	6	"	4	"
1	"	11	"	"	3	"	3 13/16	"	3	"	10	"	3	"	3	"	"	5	"	7 3/16	"	6	"	6	"
2	"	0	"	"	3	"	5 9/16	"	4	"	0	"	3	"	4	"	"	5	"	9 13/16	"	6	"	8	"
2	"	1	"	"	3	"	7 5/16	"	4	"	2	"	3	"	5	"	"	5	"	11	"	6	"	10	"
2	"	2	"	"	3	"	9 1/16	"	4	"	4	"	3	"	6	"	"	6	"	0 3/4	"	7	"	0	"
2	"	3	"	"	3	"	10 3/4	"	4	"	6	"	3	"	7	"	"	6	"	2 1/2	"	7	"	2	"
2	"	4	"	"	4	"	0 1/2	"	4	"	8	"	3	"	8	"	"	6	"	4 5/16	"	7	"	4	"
2	"	5	"	"	4	"	2 1/4	"	4	"	10	"	3	"	9	"	"	6	"	5 1/16	"	7	"	6	"
2	"	6	"	"	4	"	3 15/16	"	5	"	0	"	3	"	10	"	"	6	"	7 1/16	"	7	"	8	"
2	"	7	"	"	4	"	5 11/16	"	5	"	2	"	3	"	11	"	"	6	"	9 1/16	"	7	"	10	"
2	"	8	"	"	4	"	7 7/16	"	5	"	4	"	4	"	0	"	"	6	"	11 1/8	"	8	"	0	"
2	"	9	"	"	4	"	9 3/16	"	5	"	6	"													

Angle of 22½-67½ Degrees.

1	ft.	6	in.	by	3	ft.	7 7/16	in.	3	ft.	11	in.	2	ft.	10	in.	by	9	ft.	10 1/16	in.	7	ft.	4 13/16	in.
1	"	7	"	"	3	"	9 7/8	"	4	"	1 5/8	"	2	"	11	"	"	7	"	0 1/2	"	7	"	7 7/16	"
1	"	8	"	"	4	"	0 5/16	"	4	"	4 1/16	"	3	"	0	"	"	7	"	2 1/16	"	7	"	10 1/8	"
1	"	9	"	"	4	"	2 11/16	"	4	"	6 7/8	"	3	"	1	"	"	7	"	5 5/16	"	8	"	0 11/16	"
1	"	10	"	"	4	"	5 1/8	"	4	"	9 1/2	"	3	"	2	"	"	7	"	7 3/4	"	8	"	3 1/16	"
1	"	11	"	"	4	"	7 1/2	"	5	"	0 1/8	"	3	"	3	"	"	7	"	10 1/8	"	8	"	5	"
2	"	0	"	"	4	"	9 15/16	"	5	"	2 11/16	"	3	"	4	"	"	8	"	0 5/16	"	8	"	8 1/2	"
2	"	1	"	"	5	"	0 5/8	"	5	"	5 5/16	"	3	"	5	"	"	8	"	3	"	8	"	11 1/8	"
2	"	2	"	"	5	"	2 3/4	"	5	"	7 11/16	"	3	"	6	"	"	8	"	5 3/8	"	9	"	1 3/4	"
2	"	3	"	"	5	"	5 1/16	"	5	"	10 1/16	"	3	"	7	"	"	8	"	7 11/16	"	9	"	4 3/8	"
2	"	4	"	"	5	"	7 5/8	"	6	"	1 1/16	"	3	"	8	"	"	8	"	10 1/4	"	9	"	7	"
2	"	5	"	"	5	"	10	"	6	"	3 3/4	"	3	"	9	"	"	9	"	0 5/8	"	9	"	9 1/16	"
2	"	6	"	"	6	"	0 7/16	"	6	"	6 3/8	"	3	"	10	"	"	9	"	3 1/16	"	10	"	0 5/16	"
2	"	7	"	"	6	"	2 13/16	"	6	"	9	"	3	"	11	"	"	9	"	5 7/16	"	10	"	2 11/16	"
2	"	8	"	"	6	"	5 1/4	"	6	"	11 5/8	"	4	"	0	"	"	9	"	9 7/8	"	10	"	5 1/16	"
2	"	9	"	"	6	"	7 11/16	"	7	"	2 1/4	"													

SIZES OF FREIGHT CARS AND LEGAL RAILWAY CLEARANCES



Car.	A	B	C	D	E	F	G	H	I	J
North-Western	59″	9′-0″	9′- 4″	10′- 4″	10′-10″	38″	34′- 0″	60″	49″	7′-6″
Chicago & Alton	"	9′-3″	9′- 0″	10′- 6″	11′- 0″	36″	40′- 6″	72″	48″	7′-8″
New York Central	"	9′-3″	9′- 2″	10′- 2″	10′-10″	42″	36′- 6″	72″	48″	8′-0″
Baltimore & Ohio	"	9′-4″	8′-10″	9′-10″	10′- 6″	37″	36′- 6″	72″	42″	7′-7″
Pacific Fruit Express	"	9′-3″	9′- 0″	9′-10″	10′- 3″	40″	33′- 9″	48″	50″	6′-2″
North-Western Furniture	"	9′-6″	10′- 6″	11′- 6″	12′- 0″	30″	50′- 6″	144″	40″	9′-8″
Cotton Belt	"	9′-3″	9′- 6″	10′- 6″	11′- 6″	38″	36′- 6″	62″	48″	7′-8″
Chicago & Alton	"	9′-2″	8′- 8″	9′- 8″	10′-11″	37″	34′- 8″	66″	47″	6′-8″
North-Western	"	9′-4″	9′- 2″	10′- 2″	11′- 2″	39″	36′- 6″	60″	49″	7′-6″
North-Western	"	9′-2″	8′- 5″	9′- 6″	10′- 7″	36″	34′- 6″	60″	46″	6′10″
Erie	"	9′-6″	8′- 8″	9′- 8″	10′-10″	40″	34′-10″	62″	50″	6′10″

FIG-1

FIG-2

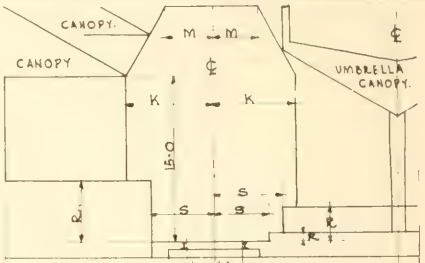


FIG-3 FIG-4

Fig. 1. Buildings and Miscellaneous Structures adjacent to Main Tracks, L = 21′ 6″, K = 8′ 0″; Adjacent to Subsidiary Passenger Tracks L = 21′ 6″, K = 7′ 6″; Tracks entering buildings L = car clearance (see diagram above for estimate), K = 7′ 0″.

Structures adjacent to Subsidiary Freight Tracks except as otherwise specified. Tracks outside buidings L = 21′ 6″, K = 8′ 0″; Tracks entering buildings L = practical car clearance, K = 7′ 0″.

Fig. 2. Bridges supporting Main Tracks or Subsidiary Freight Tracks clearance shall be as follows: L = 21′ 3″, M = 4′ 2″, 0″, P = 4′ 0″, Q = 5′ 0″. Bridges spanning Main Tracks or Subsidiary Freight Tracks Fig. 1. L = 21′ 6″, K = 8′ 0″.

Fig. 3. High Freight Platforms R = not to exceed 5′ 8″, S = not less than 5′ 8″ except when such platforms have S = not less than 8′ 0″.

Fig. 4. High Passenger Platforms on exclusive passenger tracks may have R = height of car floor above rail. Low passenger platforms R = 0′ 8″, S = not less than 5′ 0″.

Size of Swimming Tank.

Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no less. (A tank ½ inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 8 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard end should be six feet. Interior of tank, both sides and bottom, should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

Size of the Billiard Room and Bowling Alleys.

Table	Outside dimensions	Room space required
1	2½′x 5′	2′ 9″ x 4′ 10″	10′ x12′
2	3′ x 6′	3′ 4″ x 5′ 11¼″	11′ x14′
3	3½′x 7′	3′ 11″ x 7′ 1″	12′ x15′
4	4′ x 8′	4′ 7″ x 8′ 5″	14′ 2″x18′
5	4½′x 9′	4′ 11½″x 9′ 1½″	14′ 6″x18′ 9″
6	5′ x10′	5′ 5½″x10′ 1½″	15′ x20′
7	6′ x12′	6′ 8″ x12′ 6″	16′ x22′

1, 2 and 3 sizes adaptable to home use, 4, 5 and 6 to recreation rooms, 7, English style. Standard Cue 57″ long.

For dimensions required to use two or more tables of any size or sizes furnished, see manufacturer for a single pair of 2 Regulation bowling alleys. The length, from back wall to the front of the approach, should never be less than 82 ft. This allows for pit and swinging cushion 4 ft.; for alley (to foul line) 63 ft., and for approach, 15 ft. Width is 11′ x 5¼″ but can be reduced if necessary. Space for players' seats or for spectators should be in addition to the lengths and widths given. All drawings show concrete foundation construction which is necessary for basement installation and first floors where there is no basement.

Weight of Brickwork

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9	inch wall	84 lb.
13	inch wall	121 lb.
18	inch wall	168 lb.
22	inch wall	205 lb.
26	inch wall	243 lb.

Measurement of Old Brick

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic foot, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic feet to M. (Usually sold at 60 cubic feet to M to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M, to allow for waste and bats.)

Measurement of New Brickwork

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains 22½ common brick, or 7½ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Masons' and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from 17½ to 19½, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall; and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain 6¾ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

Cement Mortars

Recent developments in building codes and construction practice have shown a marked tendency toward the more extended use of portland cement mortars.

Where greatest strength is required cement and sand mortar is almost invariably recommended; for a mortar with easy working and good weathering qualities, and with sufficient strength for all ordinary purposes, equal parts of cement and lime, with six parts of sand, is the formula generally adopted. The following paragraphs suggest good practice in specifying various types of mortar:

Mortar

Portland cement mortar used in laying up masonry shall be mixed in the proportion of one part of portland cement to not more than three parts of sand, measured by volume. Hydrated lime or lime putty may be added to an amount not exceeding 15 per cent, by volume, of the portland cement used.

Cement-and-lime mortar shall be mixed in the proportion of one part of portland cement and one part of lime to not more than 6 parts of sand, all by volume.

Lime or natural cement mortar shall be mixed in the proportion of one part of lime or cement to not more than 3 parts of sand measured by volume.

Whenever cement-and-lime mortar or natural cement mortar is used instead of portland cement mortar, the allowable working stresses on the masonry shall be reduced to 80 per cent of that allowed with portland cement mortar.

Whenever lime mortar is used instead of portland cement mortar, the maximum allowable working stress shall be reduced to 50 per cent of that specified for masonry laid up with portland cement mortar.

Where masonry is to be highly stressed, mortar is often tested. The following table shows what the strength of the various types of mortar should be, where tests are deemed advisable:

Strengths of Mortars Under Typical Field Condition*

Aggregates, by volume	Water Per cent[1]	Compressive Strength at 28 days. Average of five 2-inch cubes or cylinders stored in air. Lbs. per sq. in.
1:3 Portland cement and sand	22	500
1:1:6 Portland cement, hydrated lime and sand	25	200
1:1:4 Portland cement, hydrated lime and sand	25	300
1:3 Hydrated lime and sand	30	30

*See page 30, "Recommended Minimum Requirements for Masonry Wall Construction," Report of Building Code Committee, U. S. Department of Commerce.

[1]Percentages in terms of total weight of dry materials. The water proportions given are those ordinarily used for mortar for laying brick; not those necessarily resulting in the greatest mortar strength.

The cleanliness of the sand used has an important effect upon the strength of mortar or concrete. Excessive amounts of silt, clay, loam or organic matter are harmful. The influence of these impurities is somewhat irregular and therefore clean sand should be insisted upon. Care should also be taken not to permit the use of sand which has become mixed with soil at the bottom of storage piles.

The following data will assist in estimating the quantities of material needed for brick work when portland cement mortar is used: Ordinarily approximately 13.8 cu. ft. of mortar is required to lay 1,000 brick. 2.4 barrels of cement and 1.06 cu. yds. of sand are required to produce 1 cu. yd. of cement mortar. It is customary to assume that one bag of portland cement equals 1 cu. ft. and that a bag of hydrated lime equals about 1¼ cu. ft. In proportioning mortar, if the sand is thoroughly dry, a small reduction in the standard amount of sand used is desirable.

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 685.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Slating.

FILE 695.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches.....	1/8	3/16	1/4	3/8	1/2
Weight in pounds.....	1.81	2.71	3.62	5.43	7.25

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using ½-inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using ½-inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

Capacity of Cisterns.

FILE 697.3

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.	SQUARE CISTERN.
5 feet in diameter holds 4.66 bbls.	5 feet by 5 feet holds 5.92 bbls.
6 feet in diameter holds 6.71 bbls.	6 feet by 6 feet holds 8.54 bbls.
7 feet in diameter holds 9.13 bbls.	7 feet by 7 feet holds 11.63 bbls.
8 feet in diameter holds 11.93 bbls.	8 feet by 8 feet holds 15.19 bbls.
9 feet in diameter holds 15.10 bbls.	9 feet by 9 feet holds 19.39 bbls.
10 feet in diameter holds 18.65 bbls.	10 feet by 10 feet holds 23.74 bbls.

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter.	External Circumference, A	Length of Pipe per Sq. Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In	In.	Ft.	In.	In	Ft	Lbs.			Lbs.
⅛	40	1 272	9.44	012	129	2,500	.24	27	.0006	005
¼	.54	1.636	7.075	049	229	1,385.	.42	18	.0026	021
⅜	67	2.121	5.657	110	358	751.5	.56	14	0057	.047
½	84	2 652	4.502	196	554	472.4	.84	14	0102	085
¾	1 05	3 299	3 637	441	866	270.	1.12	11½	0230	190
1	1 31	4 134	2 903	785	1.357	166.9	1 67	11½	0408	.349
1¼	1 66	5.215	2 301	1 227	2 164	96.25	2.25	11½	063S	527
1½	1 9	5.969	2.01	1.767	2 835	70.65	2.69	11½	0918	760
2	2 37	7.461	1 611	3.141	4.330	42.36	3.66	8	1632	1.356
2½	2 87	9 032	1 328	4.908	6.491	30.11	5.77	8	2550	2.116
3	3 5	10 996	1.091	7.068	9.621	19.49	7.54	8	3673	3 049
3½	4	12.566	955	9 621	12 566	14.56	9 05	8	.4998	4 155
4	4 5	14 137	849	12.566	15.904	11.31	10.72	8	6528	5.405
4½	5.	15 708	765	15.904	19 635	9 03	12.49	8	8263	6.851
5	5.56	17 475	629	19 635	24.299	7 20	14.56	8	1.020	8.500
6	6 62	20 813	577	28 274	34.471	4 98	18 76	8	1 469	12.312
7	7.62	23 954	505	38 484	45.663	3.72	23 41	8	1.999	16.662
8	8 62	27.096	.444	50.265	58 426	2.88	28 34	8	2 611	21.750
9	9 68	30 433	394	63 617	73.715	2 26	34 67	8	3.300	27 500
10	10 75	33.772	355	78.540	90.792	1 80	40 64	8	4 081	34 000

* The Standard U S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foo

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.	1 foot in 40 is 132 feet per mile.
1 foot in 20 is 264 feet per mile.	1 foot in 50 is 106 feet per mile.
1 foot in 25 is 211 feet per mile.	1 foot in 100 is 53 feet per mile.
1 foot in 30 is 176 feet per mile.	1 foot in 125 is 42 feet per mile.
1 foot in 35 is 151 feet per mile.	

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) in 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. Odor: Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. Taste: If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Capacity of Drain Pipe.

Size of Pipe.	GALLONS PER MINUTE.							
	½-in. Fall per 100 ft.	3-in. Fall per 100 ft.	6-in. Fall per 100 ft.	9-in. Fall per 100 ft.	12-in Fall per 100 ft.	18-in. Fall per 100 ft.	24-in Fall per 100 ft.	36-in. Fall per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
Inches.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute	Fall.	Gallons per minute
3	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

Transmission of Heat by Various Substances.

FILE 697.7

Window glass being	1,000	Brick (rough)	200 to 250
Oak or Walnut	66	Brick Whitewashed	200
White Pine	80	Granite or Slate	250
Pitch Pine	100	Sheet Iron	1,030 to 1,110
Lath and Plaster	75 to 100		

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

	Hot Water.			Steam.	
Temperature of radiating surface (radiators) Fahr	160°	180°	200°	227° 5 Lbs.	240° 10 Lbs.
	Square Feet of Glass to 1 Square Foot Radiator Surface.				
Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Formulae for Figuring Radiation for Factories.

A formula for figuring radiation which is used by some of the best heating engineers in determining the amount of radiation for factory buildings is as follows: $\frac{G}{3.3} + \frac{W}{10.9} + \frac{V}{171} =$ sq. ft. of radiation in which, G = Glass Area.
W = Net Wall Area.
V = Volumn of air in the Room.

SIZE OF STANDARD FLUE LINING ON SALE ON THIS MARKET.

Outside size.	Inside size.	Inside area.
4¼ x 8½ in.	3⅛ x 7¼ in.	22.6 sq. in.
8½ x 8½ in.	7 x 7 in.	49 sq. in.
13 x 13 in.	11⅝ x 11⅝ in.	135 sq. in.
4½ x 13 in.	3⅛ x 11⅝ in.	36.5 sq. in.
8½ x 13 in.	6⅝ x 11⅝ in.	77 sq. in.
13 x 18 in.	11½ x 16¾ in.	193 sq. in.
8½ x 18 in.	6⅞ x 16½ in.	114 sq. in.
18 x 18 in.	15¾ x 15¾ in.	247 sq. in.
21 x 21 in.	19½ x 19½ in.	
24 x 24 in.	21½ x 21½ in.	

GENERAL RULE FOR BRICK STACKS.

Diameter of base should not be less than 1/10 of height if square, or round, 1/12 of height. Batter of stacks 3/100 of an inch to the foot in height. Thickness of brick work should be not less than one brick from top to 25 feet below same, changing to 1½ brick from 25 feet to 50 feet below top, increasing ½ brick in thickness for each succeeding 25 feet, measuring from the top downward.

Fireplace Flue Areas.

For three-story building, area at top of smoke chamber should be 1/12 of area of fireplace opening.

Two-story building area at top of smoke chamber should be 1/10 of area of fireplace opening.

One-story building area at top of smoke chamber should be ⅛ area of fireplace opening.

Throat of fireplace should never be less than 3 in. or more than 4½ in. by the width of fireplace opening.

Front edge of arch should never be thicker than one-half brick, approximately 4 in.

Splay of sides of flue from throat opening up to flue lining should be 2 in. to the foot. The raise from soffit or lintel, or from highest point or soffit to arch should be 6 in.

Proportion of Parts of Steam Heating Boilers.

FILE 697.43

FROM PROF. R. C. CARPENTER.

Radiating surface=square feet	250	500	750	1000	1500	2000	3000	4000	5000	7500	10000
Nominal horse-power	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0	50.0	75.0	100.0
Ratio radiating to heating surface	4.5	5.1	5.4	5.6	6.0	6.2	6.7	6.9	7.0 9.0*	7.0 9.0*	7.0 9.0*
Probable evaporation per lb. coal	5.5	5.7	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Pounds of steam per sq. ft. grate (A)	55.0	57.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0
Pounds of steam per sq. ft. grate (B)	44.0	46.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Ratio radiating to grate surface (A)	165.0	171.0	180.0	195.0	210.0	225.0	240.0	255.0	270.0	285.0	300.0
Ratio radiating to grate surface (B)	132.0	138.0	144.0	156.0	168.0	180.0	192.0	204.0	216.0	228.0	240.0
Ratio heating to grate surface (A)	36.5	33.2	33.2	34.8	35.0	36.2	36.5	37.0	38.5	40.5 31.5*	42.5 33.3*
Ratio heating to grate surface (B)	28.5	27.0	26.7	27.7	28.0	29.0	29.3	29.6	30.8	32.2 25.2*	34.5 26.5*
Heating surface, square feet	55.0	98.0	138.0	178.0	250.0	322.0	447.0	580.0	710.0	1071 833*	1430 1111*
Grate surface, square feet (A)	1.52	2.92	4.15	5.68	7.15	8.9	12.4	15.7	18.5	26.5	33.3
Grate surface, square feet (B)	1.88	3.88	5.4	6.37	8.92	11.2	15.5	19.5	23.2	32.5	41.5
Diameter of safety valve, inches	1.5	2.25	2.50	2.75	3.0	3.25	3.5	4.2	4.0	2 of 3	2 of 4
Diameter of smoke flues, inches	7.0	10.0	11.2	12.0	15.0	17.0	19.0	23.0	25.0	28	3A
Square inches in above flues	38.5	78.5	95.0	113.0	176.7	227.0	283.5	415.5	490.9	615.7	907.9

* Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

THE ORDERS AND THEIR APPLICATION

By ALFRED W. S. CROSS, M. A., F. R. I. B. A., and ALAN E. MUNBY, M. A.

Introduction.

So many scholarly works upon the Orders are in existence, that some explanation seems to be called for in introducing another series of articles upon a subject that is, to all appearances, already well worn.

Notwithstanding the consensus of opinion as to the general proportions that ought to be followed in their delineation, an opinion based upon the rules laid down by the architects of an early period of the Renaissance, a surprising divergence from the precepts and practices of these old masters of their art is to be found in many buildings of our own time.

The writers are only aware of the existence of one book which seems to meet the usual office requirements, and that is a work entitled: "Rules for Drawing the Several Parts of Architecture," by James Gibbs, published in 1732; a book that has never been reprinted and copies of which are not now readily obtainable. The object aimed at, and successfully attained, is an illustration and description of an example of each Order, not "after Gibbs," but representing one of a good average type of design so proportioned that the dimensions of the various parts bear simple and easily discernible ratios one to another.

An attempt has been made to co-ordinate the leading features of the book by re-drawing some of the illustrations, retaining the useful dimensions shown thereon and entirely re-writing the description of the plates, with the introduction of some general principles likely to be of value to the draughtsman and student, for which purpose the opinions of standard writers, particularly those of Sir William Chambers, have been freely incorporated.

Before attempting such a condensation of the material in the book it was thought desirable to ascertain how far the generalizations adopted by Gibbs really represent the proportions used by acknowledged authorities. For this purpose the average ratio of the diameter of the column to the height of the entablature, as being a relation which essentially affects the whole proportion of the Order, was obtained by measuring a number of recognized examples, and it may be of interest to give the results, as an indication of the actual value of the dimensions used.

The result renders it evident that the general proportions of the Orders as recommended for adoption by this architect are fully worthy of confidence.

Hence, it would obviously seem preferable to master a few main dimensions, and, having thus inculcated a general sense of proportion, to rely upon gaining familiarity with the plates by constant use, when the proportions of the smaller members of the compositions will become naturally assimilated. The Composite Order is given in Gibbs' book, but, owing to its similarity to the Corinthian and to the absence of a consensus of opinion as to its dimensions, it has not been included in the present work.

No encroachments have been shown on any of the Orders to avoid distracting attention from the dimensions. With the exception of the whole of the Tuscan Order and of the frieze of the Ionic Order there are few members, apart from mere fillets, which have not been enriched, by some form of ornament, in one or another example, the Doric naturally the least and the Corinthian the most. In the latter Order, in fact, even the cyma and corona of the cornice, in addition to the frieze, ogees and beads, are often ornamented, but, apart from the question of expense, it is undesirable to carry such elaboration too far, as when placed in close contact with each other, especially when a distant view is alone possible, one moulding will often rob another of its effect, and, indeed, the value of richness of detail is more often than not lost in this manner.

The enrichment of columns beyond ordinary flutings is generally to be deprecated, while the application of ornament to bases and pedestals is seldom either requisite or desirable.

However great may be the utility of drawings dealing with the Orders, it should never be forgotten that they are merely a means to an end, that end being an executed building. Those whose work is confined to a drawing board develop a strong tendency to consider their compositions solely from an elevational and artistic draughtsman's point of view, and every opportunity should be taken of checking this habit and of cultivating the art of thinking "in the round." The study of perspective of buildings, and, best of all, the preparation of models of portions of a proposed building, an occupation which often results in the discovery of latent defects of design, are alike of the greatest educational value to the student of architecture.

TABLE SHOWING THE APPROXIMATE RATIO BETWEEN THE LOWER DIAMETER OF THE COLUMN AND THE HEIGHT OF THE ENTABLATURE.

Tuscan.		Doric.		Ionic.		Corinthian.	
Alberti	1:1.5	Alberti	1:2.0	Alberti	1:1.4 / 1:1.7	Alberti	1:1.8
Palladio	1:1.8	Palladio	1:1.9	Palladio	1:2.0	Palladio	1:2.0
Scamozzi	1:1.9	Scamozzi	1:2.1	Scamozzi	1:1.8	Scamozzi	2:2.0
Vignola	1:1.8	Vignola	1:2.0	Vignola	1:2.3	Vignola	1:2.5
—		Parthenon	1:2.0	Fortuna (Rome)	1:2.3	Pantheon	1:2.3
—		Baths, Diocletian	1:2.0	Baths, Diocletian	1:1.9	Jupiter Stator	1:2.5
—		Temple Pæstum	1:1.7	Minerva, Athens	1:2.3	Jupiter Tonans	1:2.2
—		Apollo, Delos	1:1.8	Illius, Athens	1:2.3	Temple Antonius	1:2.3
St. Paul's Convent Garden	1:1.8	Bow Church, Portico	1:1.9	Banqueting Hall	1:2.0	Hampden Court	1:2.2
Average	1:1.76	Average	1:1.93	Average	1:2.00	Average	1:2.00
Gibbs	1:1.75	Gibbs	1:2.00	Gibbs	1:1.82	Gibbs	1:2.00

The above examples have not been selected with any intention of justifying the proportions adopted by Gibbs, but are merely cited as those which readily occurred to the mind, or of which the dimensions could be easily obtained.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given story of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of its height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts; the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

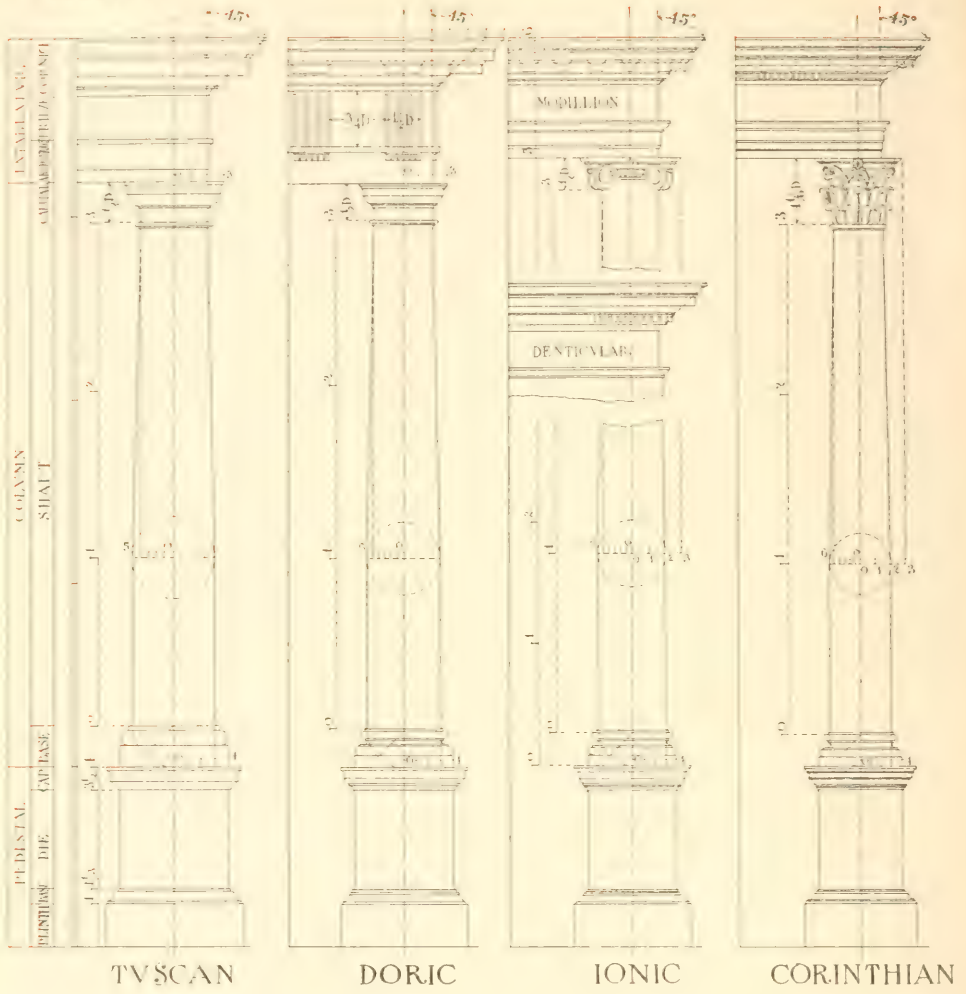
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, ⅛ total height of Order.

PLATE 1.



Height of Plinth, ¼ height of Pedestal.

Height of Pedestal Base, ⅓ height of Pedestal Plinth.

Height of Pedestal Cap, ½ height of Pedestal Plinth.

Projection of Cap and Plinth, ⅓ height of Pedestal Plinth.

Projection of Corona over Die, ¾ projection of Pedestal Cap.

Height of Column Base, ½ dameter of Column.

Projection of Base over Shaft, ⅓ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

* * *

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half of a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

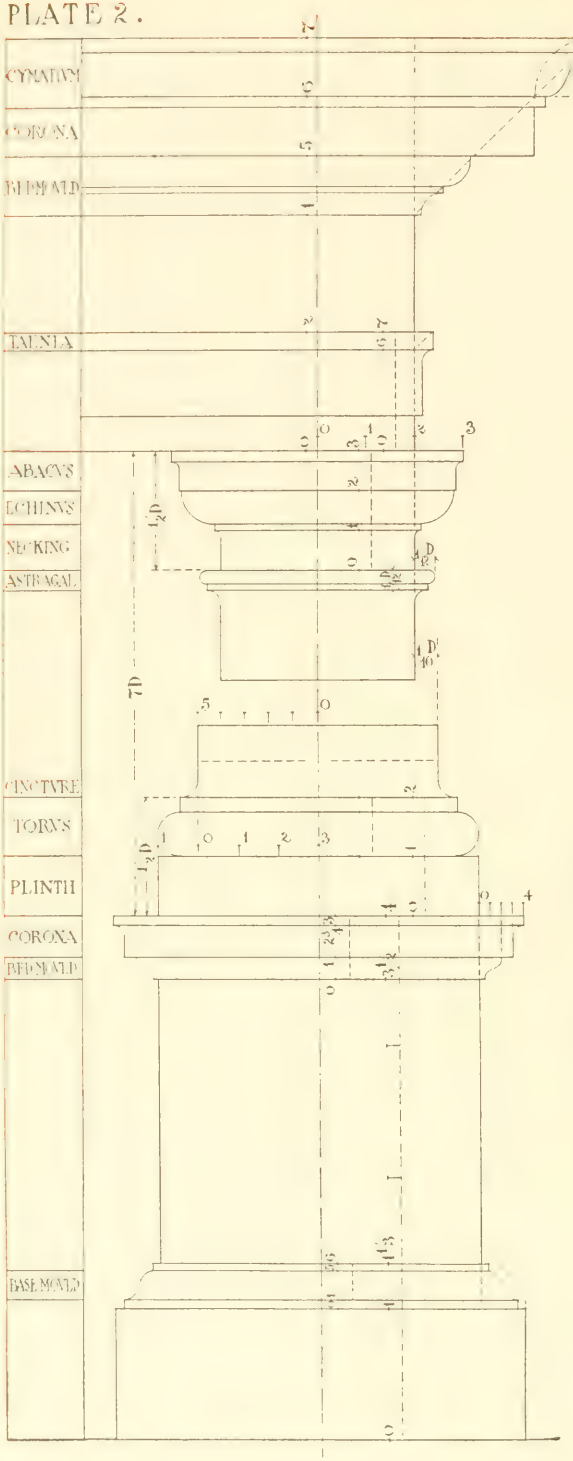
Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

"Practical Notes for Architectural Draughtsmen: The Orders and their Application."
Tabulated Dimensions of the Orders. Arranged Progressively as Required for Use.

	Dimension required.	Tuscan.	Doric.	Ionic.	Corinthian.	Dimension = 1.
	No Pedestal — Height of Entablature	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	Total height of Order.
	With Pedestal — Height of Pedestal	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	" " "
	With Pedestal — Height of Entablature	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	Height of Order less Pedestal.
	THE COLUMN.					
Vertical.	Diameter of Shaft	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	Height of Order less Entablature and Pedestal.
Vertical.	Height of Base	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Diameter of Shaft.
Vertical.	" Base Plinth	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	Height of Base.
Vertical.	" Lower Torus	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{10}$	" " less Plinth.
Vertical.	" Upper Torus	—	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	" lower Torus.
Vertical.	" Upper Torus and fillet under	—	1	1	1	" " "
Vertical.	" Capital	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{8}$	Diameter of Shaft.
Vertical.	" Necking	$\frac{1}{3}$	$\frac{1}{3}$	To eye $\frac{1}{3}$	To 1st leaf about	
Vertical.				Eye to abacus	$\frac{1}{3}$	Height of Capital (Corinthian less Abacus).
Vertical.	" Top of Neck to top of Ovolo	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	To 2nd leaf about $\frac{1}{3}$	" " " " "
Vertical.	" Abacus	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	2nd leaf to abacus about $\frac{1}{3}$	" " " " "
Vertical.	" Astragal and fillet	$\frac{1}{8}$	$\frac{1}{8}$	—	$\frac{1}{8}$	Semi-diameter of Shaft.
Vertical.	" Fillet below Astragal	$\frac{1}{3}$	$\frac{1}{3}$	—	$\frac{1}{3}$	Height of Astragal and Fillet.
Horizontal.	Projection of Base beyond Diameter	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	Semi-diameter of Shaft.
Horizontal.	" Upper Torus	—	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	" "
Horizontal.	Diminution of Shaft at Top	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	" "
Horizontal.	Projection of Cap over Shaft at Top	$\frac{1}{2}$	$\frac{1}{2}$	—	—	Semi-diameter of Shaft at Top.
Horizontal.	" Cap over Shaft at Base	—	—	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft.
Horizontal.	" Bead at top of Shaft	$\frac{1}{8}$	$\frac{1}{8}$	—	$\frac{1}{8}$	" "
	THE ENTABLATURE.					
Vertical.	Height of Architrave	$\frac{2}{9}$	$\frac{2}{8}$	$\frac{3}{10}$	$\frac{3}{10}$	Height of Entablature.
Vertical.	" Frieze	$\frac{2}{9}$	$\frac{2}{8}$	$\frac{3}{10}$	$\frac{3}{10}$	" "
Vertical.	" Cornice	$\frac{5}{9}$	$\frac{4}{8}$	$\frac{4}{10}$	$\frac{4}{10}$	" "
Vertical.	" Fillet and Cyma	$\frac{1}{3}$	$\frac{2}{8}$	Both fillets $\frac{1}{4}$	Both fillets $\frac{1}{5}$	" Cornice.
Vertical.	" Corona and Fillet over	$\frac{1}{3}$	$\frac{2}{8}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Vertical.	" Base of Corona to top of Ovolo	—	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Vertical.	" Top of Ovolo to Frieze	$\frac{1}{3}$	$\frac{2}{8}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Horizontal.	Total projection of Architrave over top diam. of Shaft	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	" Architrave.
Horizontal.	" top face of Architrave " "	$\frac{1}{8}$	$\frac{2}{3}$ (guttae)	$\frac{1}{5}$	$\frac{1}{6}$	Total projection of Architrave.
Horizontal.	" of Cornice over Frieze	1	$\frac{4}{8}$	1	1	Height of Cornice.
Horizontal.	" Inset of Corona from top of Cornice	1	$\frac{2}{8}$	1	1	" Fillet and Cyma of Cornice.
Horizontal.	" Length of Modillions (or Mutules)	—	$\frac{3}{4}$	$\frac{3}{4}$	(and ogee) $\frac{1}{3}$	Diameter of Column.
Horizontal.	$1\frac{1}{2}$ Breadth of Modillions (or Dentils)	—	(triglyph) $\frac{1}{2}$	M $\frac{1}{3}$ D $1\frac{1}{2}$	$\frac{1}{3}$	" "
Horizontal.	$2\frac{1}{4}$ Space between Modillions (or Dentils)	—	(metope) $\frac{3}{4}$	M $\frac{1}{3}$ D. $2\frac{1}{4}$		" "
	THE PEDESTAL.					
Vertical.	Height of Plinth	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	Height of Pedestal.
Vertical.	" Base	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	" Plinth.
Vertical.	" Cyma of Base	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	(and fillet) $\frac{1}{5}$	" Base.
Vertical.	" Fillet below Cyma	1	1	1	1	Fillet above Cyma.
Vertical.	" Cap	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	Height of Plinth.
Horizontal.	" Base of Corona to top of Cap	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" Cap.
Horizontal.	Projection of Cap and Plinth over Die	1	1	1	1	" Base of Pedestal.
Horizontal.	" Corona of Cap over Die	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	Projection of Cap over Die.

Note. The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dentil Cornice.

PLATE 2.



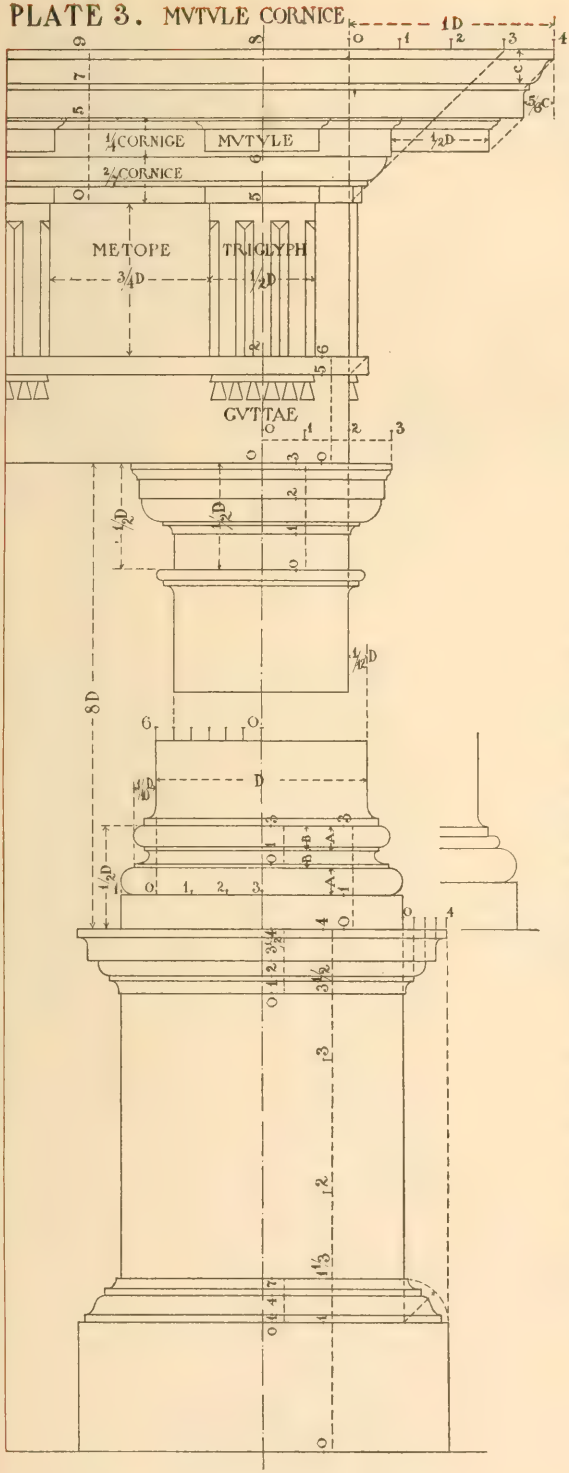
TVSCAN

Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.

PLATE 3. MVTVLE CORNICE



DENTICVLAR CORNICE

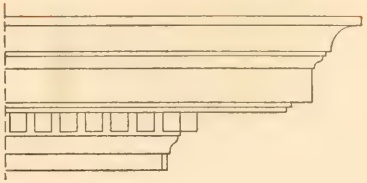


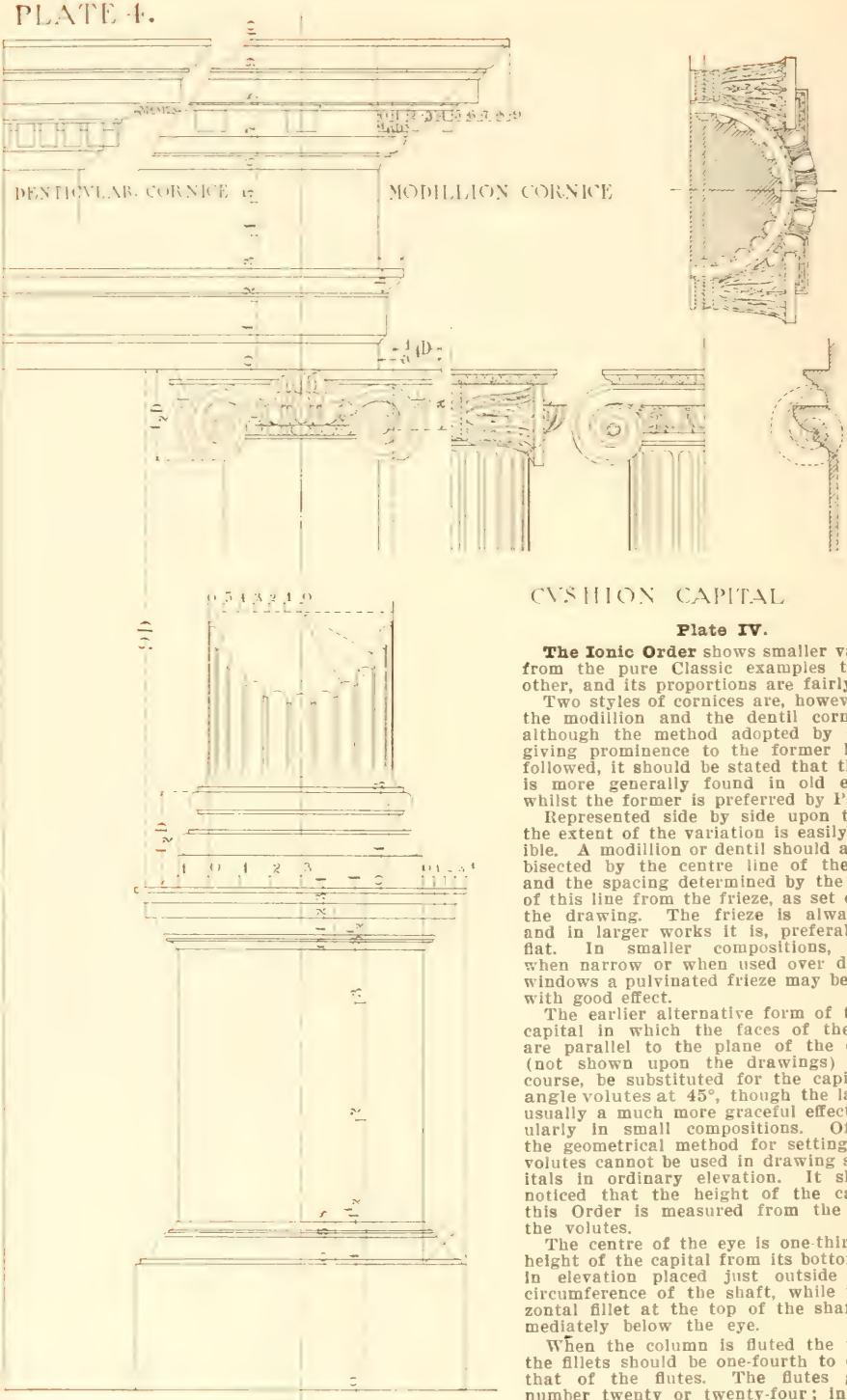
Plate III.

The Doric Order is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.

DORIC

PLATE 4.



IONIC

Plate IV.

The Ionic Order shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples, whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

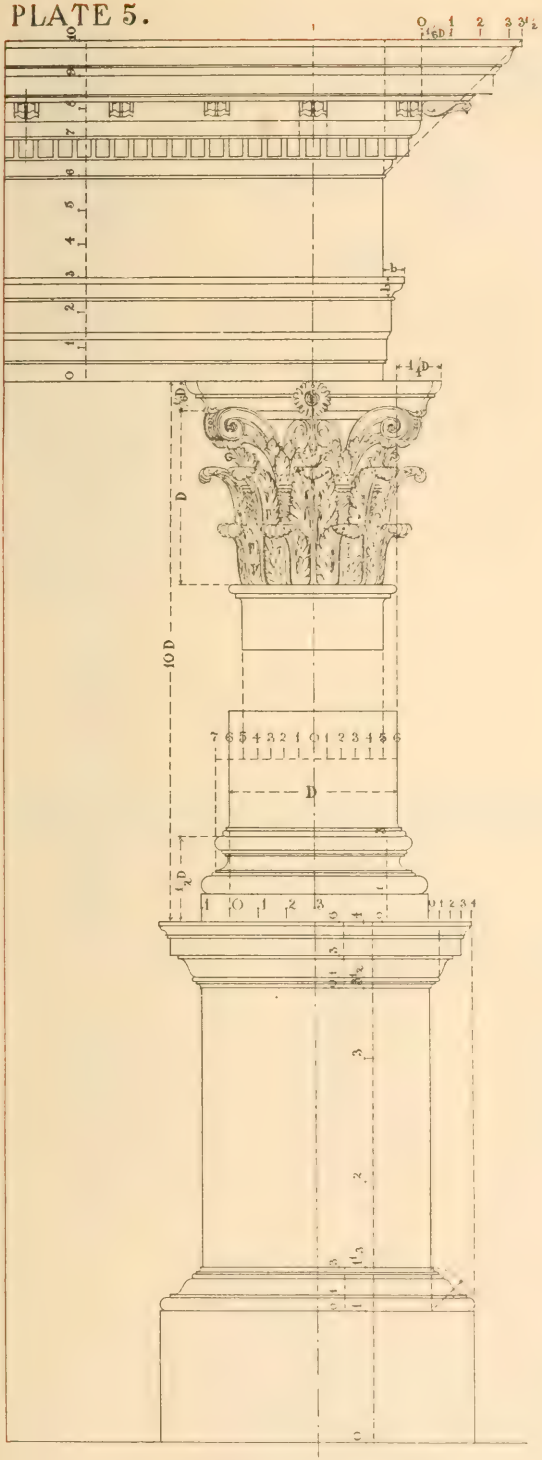
The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45°, though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four; in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the **Ionic Order.**

PLATE 5.



CORINTHIAN

Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from 1 : 1½ to 1 : 2½, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

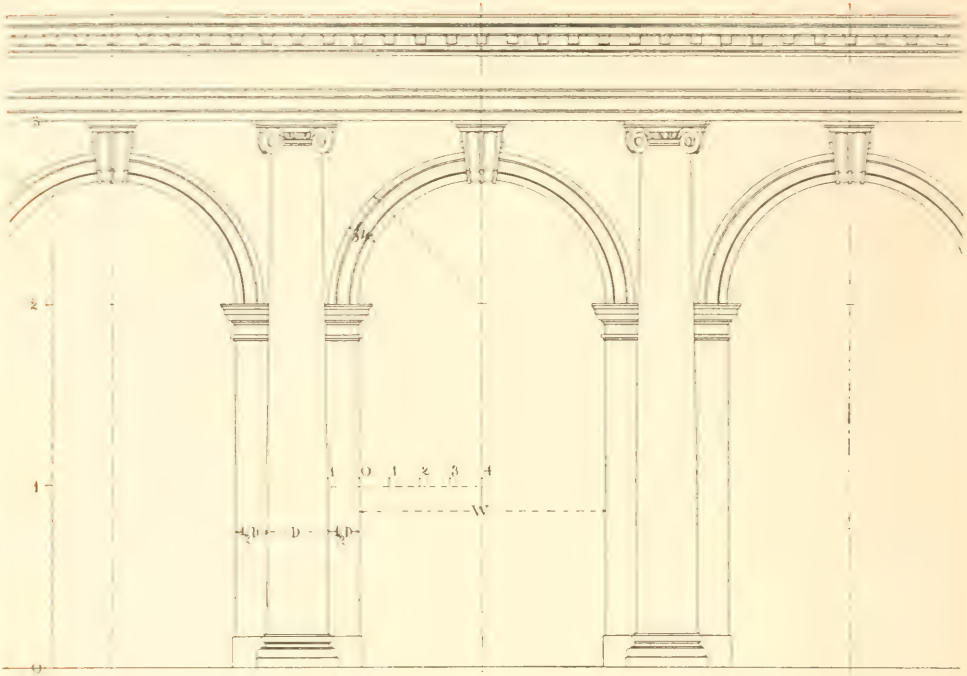
Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended :— Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice. and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

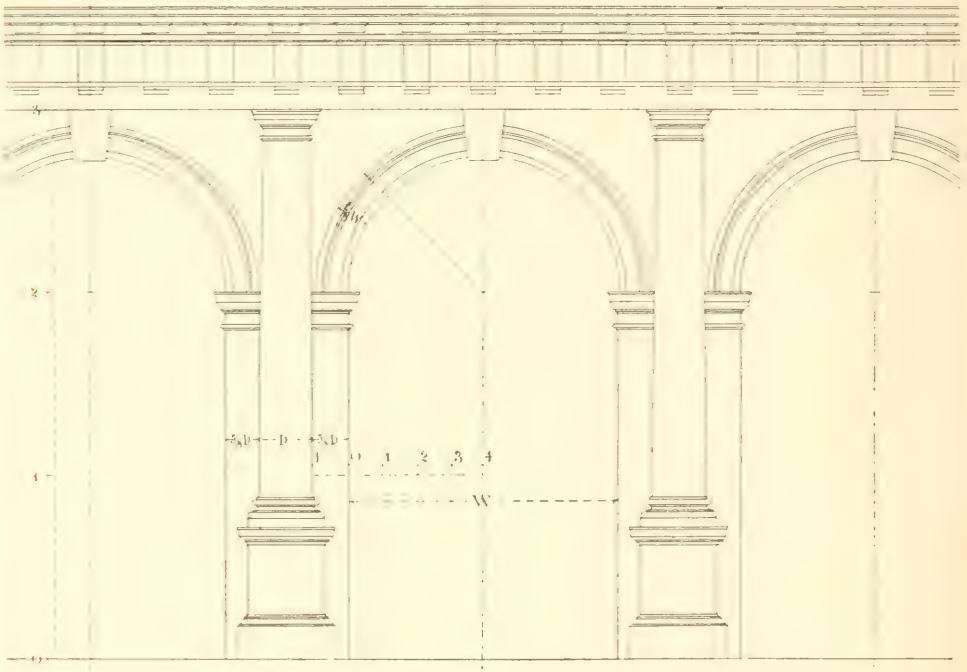
The column may or may not be fluted as in the Ionic Order.

The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing

PLATE 6.



IONIC



DORIC

Plate VI.

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be seen that a relation exists between the diameter of the column, the width of the pilaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful:

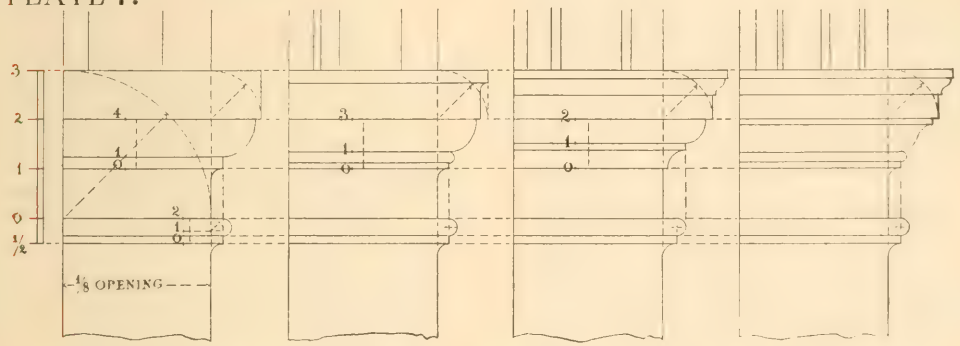
The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

Diameter of Column = 1.

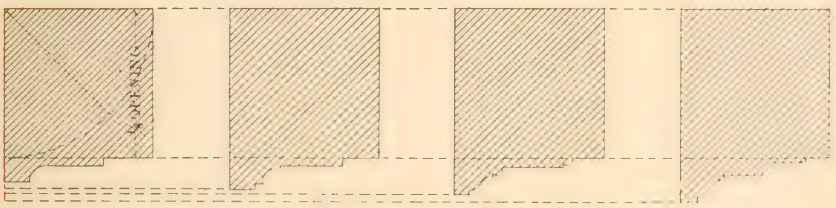
	Tuscan.		Doric.		Ionic.		Corinthian.	
	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.
Width of bay centre to center	6	7	6¼	7½	6	7½	6 5-12	8⅙
Width of one pilaster	½	⅔	½	⅝	½	⅝	⅝	7-10
Width of opening	4	4⅔	4¼	5¼	4	5¼	4⅓	5⅗

The archivolt or moulding running round the arch should be the same width as the pilaster (less any necessary clearance for the mouldings) —that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

PLATE 7.



IMPOSTS AND ARCH MOVLDS



TVSCAN DORIC IONIC CORINTHIAN

Plate VII.
Impost Mouldings.

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The divisions of the imposts are all simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below, which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by this square upon which the mouldings are placed. An examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc, in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphets, but it was soon found that the system also furnished a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

The scheme and a considerable amount of the subject matter which follows has been obtained from the original publication of Mr. Dewey, but the outline on "Building," 690 to 699, has been compiled new by the Editor. The purpose of rewriting being to bring the Index more nearly in accord with the trade groups and divisions of modern practice. The index on "Ancient," "Mediaeval" and "Modern Architecture," 722 to 724 inclusive, has been completely revised in order to bring the same down to date in accord with the latest discoveries in the realm of the history of Architecture. For the revision of this material we are deeply indebted to Prof. Rexford Newcomb, Professor of Architecture of the University of Illinois. For its co-ordination with Dewey to Miss Winifred Fehrenkamp, Librarian of the Ricker Library of Architecture, also of the University of Illinois.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and subdivision. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

0 GENERAL WORKS
1 PHILOSOPHY
2 RELIGION
3 SOCIOLOGY
4 PHILOLOGY
5 NATURAL SCIENCE
6 USEFUL ARTS
7 FINE ARTS
8 LITERATURE
9 HISTORY

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

600 USEFUL ARTS
610 MEDICINE
620 ENGINEERING
630 AGRICULTURE
640 DOMESTIC ECONOMY
650 COMMUNICATION AND COMMERCE.
660 CHEMICAL TECHNOLOGY
670 MANUFACTURES
680 MECHANIC TRADES
690 BUILDING

Omitting all sub-divisions of this topic, with the exception of **690 "Building,"** we publish the sub-divisions of same. As distinguished from **"Architectural Construction," "Building"** has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings, should be more properly classified under "Building", while matters as to types and component architectural parts are more properly classified under **Architectural Construction.**

690 BUILDING — Materials and Trades.

690.0 GENERAL.
.01 History.
.011 History of Materials.
.012 History of the Art of Building.
.013 Biography of Architects.
.014 Biography of Builders.
.015 Biography of Craftsmen.
.02 Organization of Construction.
.03 Finance of Building.
.04 Operation of Buildings.
.05 General Works on the Occupation and Art of Building.
.50 Encyclopaedia.
.051 Manuals.
.052 Handbooks.
.053 Receipts.
.054 Periodicals.
.055 Society Proceedings.
.056 Trade Unions, Guilds, Etc.
.057 Contractor's Associations.
.058 Material Dealer's Associations.
.059 Insurance.

690.1 EDUCATION OF PERSONNEL CONCERNED IN BUILDING.
.11 Education of Designers.
.12 Education of Supervisors.
.13 Education of Managers.
.14 Education of Craftsmen.

690.2 BUILDING MATERIAL IN THE ABSTRACT.
(All special material should be classified under the appropriate trade.)

690.3 PLANS FOR BUILDINGS.
.30 Incidents to the Preparation of Drawings.
.301 Drafting Room Supplies.
.302 Drafting Methods.
.31 Preliminary Studies.
.32 General Drawings.
.33 Scale Details.
.34 Full Size Details.

690.4 SPECIFICATIONS FOR BUILDINGS.
.40 Matter Pertaining to All Trades.
.40-A General Conditions of the Contract.
.41 Earth Working and Transportation Trades. (See File 691.)
.41-A Preparation of Site.
.41-B Excavations.
.41-C Construction Plant.
.41-D Grading and Filling.
.41-E Preparation of Soil, Sodding and Seeding.

690
.41-F Planting.
.42 Mortar Using Trades. (See File 692.)
.42-A Masonry Materials.
.42-B Foundation Work.
.42-C Concrete Work.
.42-D Stone Work.
.42-E Brick Work.
.42-F Fireproofing, Furring and Partitions.
.42-G Architectural Terra Cotta.
.42-H Paving.
.42-I Plastic Floors.
.42-J Plastic Reinforcement, Lathing and Furring.
.42-K Plastering.
.42-L Plastic Insulation, Pipe Covering, Etc.
.42-M Models, Clay and Plaster.
.42-N Marble and Substitutes (Including Slate, Structural Glass Terrazzo-Slabs, Etc.)
.42-O Tile and Substitutes.
690.43 Wood-Working Trades and Hardware. (See File 693.)
.43-A Wood-Working Materials and Methods.
.43-B Carpentry.
.43-C Rough Carpentry Hardware.
.43-D Finish Hardware.
.43-E Special Door, Window and Screen Hardware.
.43-F Wood Furniture.
690.44 Heavy Metal Trades (employing metal heavier than No. 10 gauge). (See File 694.)
.44-A Metal Materials and Methods.
.44-B Structural Metal (over No. 10 gauge).
.44-C Miscellaneous Metal, Fire-escapes.
.44-D Ornamental Metal (over No. 10 gauge).
.44-E Vaults, Safes, Vault Doors, Etc.
.44-F Solid Metal Sash.
.44-G Heavy Metal Doors and Shutters.
690.45 Sheet Metal Trades (employing metal of No. 10 gauge or less. See File 695).
.45-A Sheet-Metal Materials and Methods.
.45-B Ordinary Sheet-Metal.
.45-C Sheet-Metal or Sheet-Metal Covered Fire-Resisting Doors and Windows.
.45-D Art Sheet-Metal Trim and Doors.
.45-E Metal Ceilings.
.45-F Sheet-Metal Furniture.
.45-G Miscellaneous Sheet-Metal, Store-Fronts, Etc.
.45-H Utensils.
.45-I Ventilating Ducts and Stacks, Furnace Work, Etc.
690.46 Brush, Broom and Swab-Using Trades (See File 696.)
.46-A Brush Trade Materials and Methods.
.46-B Water-proofing Membrane and Mastic or other Viscous Compositions mopped, broomed or swabbed in place.
.46-C Composition Roofing.
.46-D Plain Painting and Varnishing.
.46-E Decorations (Plain, Painted or Water Color).
.46-F Hangings, Fabrics, etc.
.46-G Upholstery.
.46-H Window Shades.
.46-I Plain Glass and Glazing.
.46-J Art Glass and Glazing.
690.47 Pipe Trades. (See File 697.)
.47-A Pipe Trades Materials and Methods.
.47-B Plumbing.
.47-C Gas-fitting.
.47-D Sprinkler Fitting.
.47-E Heating (including Steam and Hot Water Heating).
.47-F Steam Power Work.
.47-G Mechanical Ventilation.
.47-H Vacuum Cleaning.
690.48 Wire and Conduit Trades (See File 698).
.48-A Wire Trades Materials and Methods.
.48-B Electrical Conduit and Wiring.

690
.48-C Lighting Fixtures.
.48-D Electrical Power Work.
690.49 Machinery and Miscellaneous Trades (See File 699).
.49-A Machinery and Miscellaneous Materials and Methods.
.49-B Elevators.
.49-C Conveying Machines.
.49-D Mechanical Cleaners.
.49-E General Machinery.
.49-F Mechanical Refrigeration.
.49-G Insulation, Pipe Covering, Etc. (See File 690.42-L.)
.49-H Refrigerators, Coolers and Freezers.
.49-I Miscellaneous Equipment not Classified.
690.5 ESTIMATES FOR BUILDINGS.
690.6 CONTRACTS AND GENERAL CONTRACTORS.
690.7 SUPERVISION OF CONSTRUCTION AND ACCOUNTS.
690.8 PROFESSIONAL SERVICES.
.80-A Remuneration, Fees, Commissions.
.80-B Duties, Relationships, Etc.
.80-C Responsibility, Etc.
.80-D License or Registration.
.81 Architect.
.82 Structural Engineer.
.83 Mechanical Engineer.
.84 Sanitary Engineer and Surveyors.
.85 Electrical Engineer.
.86 Illuminating Engineer.
.87 Clerk of the Works.
.88 Building Construction Manager.
.89 Specialists not otherwise Classified.
690.9 LAWS AND RULES CONTROLLING BUILDING.
.91 State or General Laws.
.92 Municipal Ordinances, Rules, Etc.
.93 Trade Rules.
.94 Findings, National Joint Board of Jurisdictional Awards.
.95 Lien Laws.
.96 Underwriters' Rules.
.97 Public Service Company's Rules.
.98 Liabilities of:
.981 Architects.
.982 Contractor.
.983 Workman.
.984 Owner.
.985 Bondsman.
.986 Liability Insurance Co.
.987 Adjoining Property Owner.
.988 Public.
.989 Any Other Responsibilities.

691 EARTH-WORKING, TRANSPORTATION AND TEAMING TRADES.

691.0 TOOLS, UTENSILS, APPARATUS, ETC.
.01 Shovels, Picks, Drills, Bars, Wheelbarrows, Etc.
.02 Plows, Scrapers, Trucks, Carts, Wagons, Teams, Tractors.
.03 Excavating, Trench and Mining Machinery.
.04 Hoists, Cranes, Pile Drivers, Conveyors, Etc.
.05 Dummy Railroad Equipment, Tracks, Cars, Etc.
.06 Soil Testing Apparatus.
.07 Shoring, Sheet Piling, Piling, Caissons, Etc.
.08 Scaffolding.
.071 Wood.
.072 Metal.
.073 Concrete.
.08 Blasting Powder and Apparatus.
.09 Rock Crushers.
691.1 MATERIALS TO BE REMOVED.
.11 Common Earth, Clay, Sand, Gravel, Hard-pan, Conglomerate Rock, Etc.
.12 Trees, Shrubs, Etc.
.13 Rubbish, Etc.
.14 Buildings, Vaults, Pipes, Cisterns, Etc.

691

691.2 **DISPOSAL OF MATERIALS.**
.21 **Stacking.**
.22 **Cartage.**
.23 **Dumps.**
691.3 **UTILIZATION OF MATERIALS.**
.31 **Sand and Gravel Stored for Mortar.**
.32 **Black Earth for Top Fill.**
.33 **Crushed Rock for Aggregate.**
.34 **Cleaning and Stacking Building Material for Use in New Building.**
.35 **Re-Planting and Protection of Trees and Shrubs.**
691.4 **FILLING MATERIAL.**
.5 **FERTILIZER.**
.6 **NURSERY STOCK.**
.7 **DRAINAGE MATERIAL.**
.8 **FROST PROTECTION.**
.9

692 MORTAR-USING TRADES — (Inc. Masonry, Plastering, Tile and Marble Setting and the preparation for same).

692.0 **MASONRY APPARATUS.**
.01 **Mixing Boxes, Platforms, Etc.**
.02 **Tools, Hose, Heaters, Etc.**
.03 **Mixers for Mortar and Concrete.**
.04 **Scaffolding, Horses, Planks, Etc.**
.05 **Forms.**
.06 **Erection Apparatus, Hoists, Cranes, etc.**
.07 **Chutes.**
692.1 **MATERIALS FOR MASONRY.**
.11 **Liquids, Water, Anti-freezing, Etc.**
.12 **Aggregate** (a) Sand, (b) Stone Screenings, (c) Gravel, (d) Crushed Stone, (e) Crushed Slag, (f) Cinders, (g) Haydite.
.13 **Cementing Materials for Masonry.**
.131 Limes.
.132 Hydraulic Cements, (a) Natural, (b) Portland, (c) Miscellaneous.
.133 Gypsums, (a) Plaster of Paris, (b) Keene's Cement, (c) Miscellaneous.
.134 Magnesites.
.135 Asphaltic Cements.
.136 Composite Cements.
.137 Other Cements.
.14 **Solids for Masonry.**
.141 Stone.
.142 Brick, (a) Adobe, (b) Burned Clay, (c) Sand Lime.
.143 Structural Partition and Load-bearing Tile.
.144 Terra Cotta, (a) Coping, (b) Ornamental Flue Lining, etc.
.145 Cement Blocks.
.146 Composite Blocks.
.147 Marble, Soapstone, Structural Slate and Glass.
.148 Tile, Paving and Wall.
.149 Terrazzo Blocks and Slabs.
.15 **Mason's Hardware.**
.151 Anchors, Ties, Wall Boxes, Plates, Inserts, Scoopers, Sleeves, Etc.
.152 Thimbles, Ash and Coal Chutes, Clean-out Doors, Dampers, Grate Bars, Chimney Cap, Vent Gratings, Etc.
.153 Vault Lights, Sidewalk Doors, Etc.
.154
.16 **Reinforcing for Masonry.**
.161 Bar Reinforcement.
.162 Fabric.
.163 Metal Lath.
.164 Wood-lath.
.165 Fiber, Hair, etc.
692.2 **STONE CONSTRUCTION.**
.21 **Preservatives Treatment.**
.22 **Bond, Anchorage, Ties, Lewises, Etc.**
.23 **Cutting and Dressing of Stone, Stereotomy, Drips, Weathering, Etc.**
.24 **Setting, Joints, Mortar, Bedding, Etc.**
.25 **Cleaning and Pointing.**
692.3 **BRICK CONSTRUCTION.**
.31 **Preservative Treatment.**
.32 **Common Brick Work.**

692
.33 **Fire Brick Work.**
.34 **Face Brick Work.**
.35 **Laying Joints, Mortar, Etc.**
.36 **Chases, Fire-Stops, Corbels, Etc.**
.37 **Bonds, Anchors, Etc.**
.38 **Cleaning and Pointing, Etc.**
692.4 **TERRA COTTA CONSTRUCTION.**
.41 **Preservative Construction.**
.42 **Bonding, Anchorage, Ties, Etc.**
.43 **Structural Tile Walls.**
.44 **Structural Tile Floors.**
.45 **Ornamental or Decorative Terra Cotta.**
.46 **Laying Joints, Mortar, Etc.**
.47 **Fitting Around Structural Parts.**
.48 **Centers, Supports, Protection.**
.49 **Cleaning, Pointing and Repairing.**
.5 **FIREPROOF CONSTRUCTION.**
.51 **Hollow Clay Tile, (a) Hard, (b) Porous.**
.52 **Gypsum Tile.**
.53 **Concrete.**
.54 **Tying, Fitting, Securing.**
.55 **Combination Construction.**
.56 **Centers, Forms, Etc.** (See 693.41 for Wood and 695 for Sheet-Metal.)
.59 **Patching, Repairing.**
692.6 **CONCRETE CONSTRUCTION.**
.61 **Massive, Caissons, Footings, Retaining Walls, Etc.**
.62 **High Duty Concrete.**
.63 **Hollow Concrete Building Blocks.**
.64 **Ornamental Concrete.**
.65 **Concrete Supported on the Ground, Paving of Walks, Floors, Drives, Etc.**
.66 **Waterproof Concrete.**
.67 **Reinforced Concrete.**
.671 Reinforcing Systems, Arranged Alphabetically.
.672 Forms and Centers. (See 693.41 for Wood; also 695 for Sheet-Metal.)
.673 Tests and Inspection.
.674 Data for Experiments.
.675 Formulae, (a) Vault Construction.
.676 Special Applications.
692.7 **DECORATIVE AND SANITARY WALL AND FLOOR SURFACING.**
.71 **Marble, Soapstone and Slate.**
.72 **Structural Glass.**
.73 **Terrazzo.**
.74 **Tile Mosaic,** (a) Ceramic, (b) Marble, (c) Glass.
.75 **Tile,** (a) Quarry, (b) Encaustic, (c) Marble, (e) Ornamental, (f) Composition Non-Dip, (g) Slate Fragging, (h) Rubber Tile.
.76 **Sanitary Composition Floors.**
692.8 **WATER-PROOFING AND HARDENERS.**
.81 **Integral Waterproofing** (for brush applied mastic and painting, waterproofing, see File 696).
.82 **Hardeners** (a) Surface, (b) Admixed.
.83 **Mortar Colors.**
692.9 **PLASTER TRADES.**
.91 **Interior Plaster.**
.91(a) Common Lime Plaster.
.91(b) Gypsum Plaster.
.91(c) Magnesite.
.91(d) Portland Cement Plaster.
.91(e) Lathing.
.91(f) Special Plasters.
.91(g) Modeling and Ornamental Plaster.

693 WOOD WORKING TRADES.

.0 **APPARATUS, INCIDENTAL TOOLS, ETC.**
.01 **Mechanic's Tools.**
.02 **Wood-working Power Machinery,** (a) Saws, (b) Planers, (c) Stickers, (d) Sand-papering Machines, (e) Scraping Machines.
.03 **Kilns, Dryers.**
.04 **Scaffolding, Ladders, Horses and Benches.**
693.1 **MATERIALS.**
.11 **Lumber.**
.111 Timber, larger than 6"x6".

693
.112 Common Lumber.
.112 (a) Boards, Furring and Grounds.
.112 (b) Piece Stuff, Joists and Scantling.
.112 (c) Shingles.
.113 Finish Lumber.
.113 (a) Hardwood.
.113 (b) Soft Wood.
.113 (c) Flooring.
.114 Mill Stock.
.115 Veneers.
.116 Composition.
.117 Insulation Papers and Felts.
.12 Glues.
.13 Rough Hardware.
.131 (a) Nails, (b) Spikes, (c) Brads, (d) Tacks, Etc.
.132 (a) Bolts, (b) Rods, (c) Anchors, Ties, (d) Screws, Etc.
.133 Rivets.
.134 (a) Washers, (b) Flitch Plates, (c) Splice Plates.
.135 Mill Construction H ardware, (a) Stirrups, (b) Hanger, (c) Column Caps, (d) Ties, (e) Box and Wall Anchors, (f) Bearing Plates, Etc.
.136 Double Hung Sash Hardware, (a) Pulleys, (b) Cords, (c) Chain, (d) Weights, (e) Spring Balances.
.137
.138
.14 Finish Hardware.
.141 Hanging Hardware, (a) Butts, (b) Hinges, (c) Pivots, Etc.
.142 Controlling Hardware, (a) Bumpers, (b) Strikes, (c) Holders, (d) Hooks, (e) Stays, (f) Adjusters, Etc.
.143 Fastening Hardware, (a) Old Fashion Latches, (b) Spring Latches, (c) Catches, (d) Fasts, (e) Thumb Bolts, (f) Locks, Etc.
.144 Trimming Hardware, (a) Pulls, (b) Knobs, (c) Spindles, (d) Roses, (e) Escutcheons.
.145 Protection Hardware, (a) Kick Plates, (b) Push Plates, (c) Direction Plates or Signs, (d) Push Bars, Etc.
.146 Operating Hardware, (a) Closers and Checks, (b) Springs, (c) Weights and Pulleys, (d) Window Poles, Etc.
.147 Weathering Hardware, (a) Weather Strips, (b) Thresholds, (c) Special Drips, (d) Metal Astrigals, (e) Casement Operators, Etc.
.148 Automatic and Panic Hardware.
.149 Miscellaneous Hardware not otherwise classified, (a) Wardrobe Hardware, (b) Showcase Hardware, (c) Toilet-room Hardware, (d) Leadder Hardware.

693.2 ORDINARY CONSTRUCTION.
.21 Balloon Construction for Frame Buildings.
.22 Joist Construction for Masonry Buildings.
.23 Trusses, etc.

693.3 HEAVY TIMBER CONSTRUCTION.
.31 Heavy Post and Timber Construction for Frame Buildings.
.32 Mill Construction for Masonry Buildings.

693.4 AUXILIARY WOOD CONSTRUCTION FOR FIREPROOF BUILDINGS.
.41 Centers, Forms, Protective Covering, Scaffolding, Etc.
.42 Grounds, Attachment Strips, Etc.

693.5 JOINERY AND MILL WORK.
.51 Frames and Sash.
.511 Box Frames, Double Hung Sash.
.512 Casement Frames, Sash Opening In.
.513 Casement Frames, Sash Opening Out.
.514 Frames for Sash Hinged at Bottom, Swinging In at Top.
.515 Frames for Sash Hinged at Top, Swinging In at Bottom.
.516 Frames for Sash Hinged at Top, Swinging Out at Bottom.
693
.517 Frames for Horizontal Pivoted Sash
.518 Frames for Vertical Pivoted Sash.
.52 Wood Interior Trim.
.53 Wood Floors.
.54 Blinds.
.55 Doors.
.551 Ordinary Panel and Sanitary Doors.
.552 Special Revolving Doors.
.553 Folding, Accordion Doors.
.554 Rolling Doors.
.56 Screens.
693.57 Mouldings.
693.58 Flooring Wood.
.59 Columns.
693.6 STAIR BUILDING.
693.7 ORNAMENTAL JOINERY.
.71 CABINET WORK, (a) Mantels, (b) Sideboards, (c) Cases, (d) Space Savers, (e) Panel Partitions.
.72 WOOD FURNITURE.
693.8 WOOD CARVING.
.9 MISCELLANEOUS.

694 HEAVY METAL TRADES — (Employing Metal heavier than No. 10 gauge).

.0 TOOLS, UTENSILS, APPARATUS, ETC.
.01 Job Machinery.
.02 Job Tools, Hammers, Sledges, Punches, Tongs, Reamers, Riveters, Forges, Etc.
.03 Derricks, Cable, Hoisting Machinery.
.1 MATERIALS USED IN THE METAL TRADES.
.11 Iron Products.
.111 Cast-Iron.
.112 Wrought Iron.
.113 Steel.
.114 Alloys, (a) Copper Bearing Steel, (b) Nickel Steel, (c) Sheradized Steel.
.12 Copper.
.13 Brass.
.14 Bronze.
.15 Aluminum.
.16 Miscellaneous Structural Metals.

694.2 STRUCTURAL METAL CONSTRUCTION.
.21 Fabrication.
.211 Shop Drawings.
.22 Framing.
.221 Bases, Bearing Plates, Etc.
.222 Columns and Struts.
.223 Caps, Connections, Gussets, Etc.
.224 Girders, Beams, Etc.
.225 Suspenders, Tie-Rods, Chains Etc.
.23 Preservatives.
.231 Paint. (See 696.)
.232 Galvanizing.
.233 Other Methods.

694.3 MISCELLANEOUS METAL.
.31 Fire Escapes.
.32
.33

694.4 HEAVY METAL DOORS, SHUTTERS, ETC.
.41 Underwriters' Doors.
.42 Sidewalk Doors.
.43 Shutters.

694.5 ORNAMENTAL METAL.
.51 Stairs.
.52 Enclosures, Guards, Grills, Fences, Gates, Etc.
.53 Elevator Enclosures and Cages.
.54 Fireplace Trimming.
.541 Andirons, Tongs, Pokers, Spark-screens, etc.
.542 Grate Frames, Dampers, Grates, Etc.

694.6 SOLID METAL SASH.

694.7 VAULT DOORS, SAFES, VAULTS, ETC.
.71 Vault Doors.
.72 Safes.
.73 Vaults and Bank Equipment.

694.8 Tablets Memorials, Etc.

695 SHEET-METAL TRADES — (Employing Metal of No. 10 gauge or less).

695.0 **TOOLS, UTENSILS AND APPARATUS (used by the Sheet-Metal Trades).**
.01 **Brakes, Shears, Mallets, Hammers Etc.**
.02 **Welding Machines.**
.03 **Soldering Apparatus.**
.04 **Plating Apparatus.**
695.1 **SHEET-METAL MATERIALS.**
.11 **Sheet Iron.**
.111 Tin or Tin Coated Sheet Iron.
.112 Galvanized Iron.
.12 **Sheet Copper.**
.121 Planished Copper.
.13 **Zinc Sheet.**
.14 **Brass Sheet.**
.15 **Bronze Sheets.**
.16 **Other Sheet Metals.**
.17 **Solders, Fluxes, Etc.**
.18 **Hardware.**
.181 Rivets and Bolts.
.182 Nails, Tacks and Screws.
.183 Incidental Hardware.
.19 **Miscellaneous.**
695.2 **ORDINARY SHEET-METAL CONSTRUCTION.**
.21 **Roofs.**
.211 Tin.
.212 Galvanized Iron.
.213 Copper.
.214 Slate Shingles.
.215 Composition.
.216 Tile Shingles.
.217 Cement Tile.
.22 **Cornices, Etc.**
.23 **Flashing, Gutters, Valleys, Down-Spouts and Conductor Heads.**
.24 **Sky-lights, Ventilator Heads, Etc.**
.25 **Furnace Work, Casings, Ducts and Stacks, Etc.**
695.3 **FIRE RESISTING DOORS AND WINDOWS.**
.31 **Underwriters' Tin-Clad Doors.**
.32 **Underwriters Sheet-Metal Sash.**
.33 **Rolling Steel Shutters and Doors.**
695.4 **CEILINGS, STAMPED SHEET-METAL.**
695.5 **DRAWN SHEET-METAL.**
.51 **Store Front Bars.**
.52 **Showcase Bars, Etc.**
695.6 **TRIM AND DOORS OF SHEET METAL.**
695.7 **FURNITURE OF SHEET METAL.**
695.8 **UTENSILS OF SHEET METAL.**

696 BRUSH, BROOM AND SWAB-USING TRADES.

.0 **BRUSH TRADE, TOOLS AND APPARATUS.**
.01 **Kettles, Buckets, Ladles, Swabs and Other Roofers' and Waterproofers' Tools.**
.02 **Brushes, Cans, Knives, Etc.**
.03 **Ladders, Scaffolding, Hoists, Etc.**
.04 **Drop Cloths.**
.05 **Grinders.**
.06 **Spraying Machines.**
696.1 **BRUSH TRADE MATERIALS AND METHODS.**
.11 **Roofing and Waterproofing Materials.**
.111 Felt.
.112 Paper.
.113 Gravel, Slag, Crushed Stone, Paving Tile, Etc.
.114 Tar and Asphalt.
.115 Creosote, Dipo and Stains.
.12 **Painters' Materials.**
.121 Binders, (a) Oil, (b) Casein, (c) Dryers.
.122 Pigments, (a) White Lead, (b) Red Lead, (c) Zinc, (d) Graphite, (e) Whiting, (f) Lime, (g) Other Pigments.
.123 Colors, (a) Vegetable, (b) Mineral.
.124 Solvents, (a) Turpentine, (b) Benzine, (c) Alcohol, (d) Other Solvents.

696
.125 Wood Finishing Materials, (a) Stains, (b) Fillers, (c) Shellacs, (d) Varnishes, (e) Enamels, (f) Waxes, (g) Other Materials.
.126 Prepared Paints.
.13 **Water Paints.**
.131 Binder, (a) Casein, (b) Glue, (c) Other Binders.
.132 Pigments, (a) Lime, (b) China Clay, (c) Whiting.
.133 Colors.
.14 **Wall Papers.**
.15 **Hangings and Coverings.**
.151 Fabrics.
.152 Leather, (a) Genuine, (b) Imitation.
.16 **Hanging Hardware Poles, Etc.**
.17 **Upholstery,** (a) Tacks, (b) Feathers, (c) Hair, (d) Moss, (e) Ticking, (f) Cord, (g) Other Materials.
.18 **Glazing Material.**
.181 Glass, (a) Common Glass, (b) Plate Glass, (c) Ornamental Glass, (d) Wire-glass, (e) Prismatic Glass, (f) Colored Glass, (g) Glass Substitutes.
.182 Putties.
.183 Tacks.
.184 Leading Bars, (a) Lead, (b) Zinc, (c) Copper, (d) Ventilators.
.19 **Other Materials.**
696.2 **WATER-PROOFING WORK.**
.21 **Brushed on Construction.**
.22 **Membrane.**
696.3 **COMPOSITION ROOFING WORK.**
.31 **Tar and Gravel Roofing.**
.32 **Asphaltum Composition Roofing.**
.33 **Promenade Deck Roofing.**
.34 **Mastic Floors.**
696.4 **PAINTING WORK.**
.5 **WOOD FINISHING WORK.**
.6 **GENERAL DECORATIONS.**
.61 **Ordinary Water Color Tinting.**
.62 **Fresco Painting, Stenciling, Etc.**
.63 **Mural Decorations.**
.7 **UPHOLSTERY.**
.8 **HANGINGS.**
.81 **Ordinary Window Shades, Awnings.**
696.82 **Lace Curtains.**
.83 **Draperies, Etc.**
.84 **Carpets, Rugs and Linoleums.**
696.9 **GLAZING.**
.91 **Common Glazing.**
.92 **Art Glass Glazing.**

697 PIPE TRADES.

.0 **TOOLS, UTENSILS AND APPARATUS.**
.01 **Mechanic's Chest Tools, Furnaces, Etc.**
.02 **Power Pipe Cutter, Benders, Dies, Etc.**
.03 **Scaffolding Ladders, Etc.**
697.1 **MATERIALS.**
.11 **Metals,** (a) Wrought Iron, (b) Steel, (c) Lead, (d) Brass, (e) White Metal.
.12 **Pipe.**
.121 Wrought Iron, (a) Black, (b) Galvanized.
.122 Steel, (a) Black, (b) Galvanized.
.123 Cast Iron, Duriron.
.124 Brass, Bronze and Copper.
.125 White Metal.
.126 Block Tin.
.127 Lead Lined Iron.
.128 Tin Lined Iron.
.129 Tile Pipe.
.13 **Pipe Fittings.**
.131 Screw Connections.
.132 Flange Connections.
.133 Union Connections.
.134 Caulked Connections.
.135 Valves, (a) Shut-off, (b) Gate, (c) Disk, (d) Other Valves, (e) Air Vents.
.136 Pipe Hangers, Supports, Etc.
.137 Under-Ground Conduit.
.14 **Tanks.**
.141 Hot Water.

697
.142 Cold Water, (a) Wood, (b) Metal.
.143 Oil Tanks.
.144 Gas Tanks.
.15 Boiler.
.151 Steel Water Tube.
.152 Steel Flue Tube.
.153 Cast Iron Sectional.
.16 Stoves.
.161 Coal.
.162 Gas.
.163 Oil.
.17 Furnaces, Grates and Stokers for Coal and Oil. (a) Ordinary, (b) Smokeless, (c) Dutch-oven, (d) Oil Burning, (e) Mechanical Feed.
.18 Brass Goods.
.19 Pottery.
697.2 SEWERAGE. (See 692 for Masonry Sewers.)
.3 PLUMBING TRADE.
697.31 Plumbing Fixtures.
.311 Roughing-in, (a) Durham System, (b) Cast-Iron Caulked Joint System.
.312 Water Supply, (a) Pumps, (b) Tanks, (c) Hose and Fire Apparatus, (d) Filters, (e) Sterilizers, (f) Ice Machinery, (g) Stills, Etc. (h) Domestic Heater, (i) Softeners.
.313 Garbage and Sewage Disposal, (a) Bilge Pumps.
.314 Fixtures for Plumbing, (a) Floor Drains, (b) Cesspools, (c) Sinks, (d) Slop Sinks, (e) Laundry Wash Trays, (f) Lavatories, (g) Bathtubs, (h) Showers, (i) Water Closets, (j) Urinals, (k) Bath and Toilet Room Trimmings, Paper-Holders, Towel Racks, Tumbler Holders, Soap Dishes, Etc.
.315 Laundry Machinery.
.316 Kitchen Machinery.
697.4 GAS FITTING.
.41 Meters.
.42 Fixtures.
.43 Gas-water Heaters.
697.5 MECHANICAL CLEANING.
.6 SPRINKLER FITTING.
.60 Erecting Apparatus.
.61 Sprinkler-fitting Devices.
.7 HEATING, STEAM AND HOT WATER AND VENTILATION.
.71 One-Pipe Gravity.
.72 Two-Pipe Gravity.
.73 Vapor Two-Pipe. (Systems arranged alphabetically.)
.74 Vacuum. (Systems arranged alphabetically.)
.75 Radiation, (a) Direct, (b) Direct-Indirect, (d) Indirect.
.76 Boiler Trimmings.
.77 Automatic Regulators.
.78 Mechanical Ventilation, Air Washers and Filters.
697.8 STEAM-POWER WORK.
.9 OTHER PIPE TRADES.

698 WIRE AND CONDUIT TRADES—Electrical Work of All Kinds.

.0 TOOLS, UTENSILS AND APPARATUS.
698.1 MATERIALS FOR WIRE TRADES.
.11 Conduit.
.111 Pipe.
.112 Flexible Greenfield, Etc.
.113 Moulding, (a) Wood, (b) Metal.
.114 Tile and Porcelain.
.115 Knob and Tube Substitute.
.12 Insulation.
.13 Wire, (a) Gauges, (b) Kinds.
.14 Switchboards. Miscellaneous Devices.
.141 Switchboards.
.142 Switches.
.143 Cut-out Cabinets, etc.

698
.144 Transformers.
.145 Receptacle Sockets.
.146 Door Openers.
.147 Batteries.
.15 Lighting Fixtures, (a) Sockets, (b) General Fittings, (c) Pendents, (d) Brackets, (e) Indirect (f) Semi Indirect, (g) Special Reflectors.
.16 Telephones, Speaking Tubes, Bells, Etc.
.161 Private Telephones.
.162 Signal System.
.163 Speaking Tube.
.164 Letter Boxes, Etc.
.17 Motors and Generators.
.18 Lightning Rods.
.19 Miscellaneous, (a) Stoves, (b) Fans.
698.2 GENERAL HOUSE WIRING FOR ILLUMINATING AND MINOR POWER WORK.
698.3 TELEPHONE WORK.
698.4 ELECTRIC POWER WORK.
698.5 CENTRAL STATION WORK.
698.6 OTHER ELECTRICAL WORK.

699 MACHINERY TRADES AND MISCELLANEOUS BUILDING ITEMS—(Not Otherwise Classified).

699.0 GENERAL MATTERS PERTAINING TO THE PREPARATION AND ERECTION OF MACHINERY.
699.1 MATERIALS.
699.2 ELEVATORS.
699.3 CONVEYING MACHINES.
699.4 MECHANICAL REFRIGERATION.
699.5 GENERAL MACHINERY.
699.6 INSULATION, PIPE COVERING, ETC. (See 692 for Plastic Pipe Covering.)
699.7 REFRIGERATORS, COOLERS AND FREEZERS.
699.8 Kitchen and Laundry Machinery.
699.9 MISCELLANEOUS TRADES NOT OTHERWISE CLASSIFIED.

700 FINE ARTS.

701 PHILOSOPHY. THEORIES. UTILITY. AESTHETICS.
702 COMPENDS. OUTLINES.
703 DICTIONARIES. CYCLOPEDIAS.
704 ESSAYS. LECTURES. ADDRESSES.
705 PERIODICALS. MAGAZINES. REVIEWS.
706 SOCIETIES. TRANSACTIONS. REPORTS, ETC.
707 EDUCATION. STUDY AND TEACHING OF ART.
708 ART GALLERIES AND MUSEUMS.
709 HISTORY OF ART IN GENERAL. Divided like 930-999.

710 LANDSCAPE GARDENING.

711 PUBLIC PARKS.
712 PRIVATE GROUNDS. LAWNS.
713 WALKS. DRIVES. BRIDGES.
714 WATER. FOUNTAINS. LAKES.
715 TREES. HEDGES. SHRUBS. See also 634.9, Forestry; 582, Botany.
716 PLANTS. FLOWERS. .1, Plants; .2, Flowers; .3, Conservatories; .4, Window gardens; .5, Ferneries.
717 ARBORS. SEATS. OUTLOOKS.
718 MONUMENTS. MAUSOLEUMS.
719 CEMETERIES. See also 393.1, Earth burial; 614.61, Public health.

722 ANCIENT AND ORIENTAL ARCHITECTURE (Pagan).

722.0 PRIMITIVE.
.04 Europe.
.05 Asia.
.06 Africa.

722
.07 **America.**
722.1 **EGYPTIAN** (PERIOD DIVISION).
.11 **Ancient and Middle Empire** (4000-2000 B. C.)
.12 **Shepherd Kings** (2000-1600 B. C.)
.13 **Theban New Empire** (1600-1250 B. C.)
.14 **The Decadence** (1150-622 B. C.)
.15 **Restoration** (Saite Period 663-525 B. C.)
.16 **Ptolemaic Period** (332-30 B. C.)
722.2 **EASTERN ASIATIC.**
.21 **Chinese.**
.22 **Japanese.**
.23 **Korean.**
722.3 **WESTERN ASIATIC.**
.31 **Chaldean.**
.311 Summerian.
.312 Akkadian.
.32 **Assyrian.**
.33 **Persian.**
.331 Ancient.
.332 Sassanian.
.34 **Hittite.**
.35 **Phoenician.**
.36 **Jewish.**
.37 **Cypriote.**
.38 **Lycian.**
722.4 **CENTRAL ASIATIC** (INDIAN).
.41 **Hindu.**
.42 **Buddhist.**
.43 **Jaina.**
.44 **Dravidian.**
.45 **Chalukyan.**
.46 **Burmese.**
722.5 **ANCIENT AMERICAN.**
.51 **Mexico and Central America.**
.511 Toltec.
.512 Aztec.
.513 Maya.
.52 **South America.**
.521 Inca (Peruvian and others).
722.6 **PRE-CLASSIC.**
.61 **Aegean** (Grecian Archipelago)
.611 Cretan or Minoan.
.612 Mycenean.
.613 Trojan.
.62 **Etruscan** (Italy).

Classic.

722.7 **GREEK.**
.71 **Greece.**
.711 Archaic.
.712 Periclean
.713 Hellenistic.
.72 **Asia Minor.**
.73 **Italy.**
.74 **Sicily.**
.75 **Africa.**
722.8 **ROMAN.**
.81 **Italy.**
.811 Etruscan influence, 493-40 B. C.
.812 Graeco-Roman influence, 212-27 B
.813 Augustan, 27 B. C.-14 A. D.
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.83 **Germany and Austria.**
.84 **France.**
.85 **Spain.**
.86 **Asia.**
.87 **Africa.**
.88 **Britain.**

(Arbitrary numbers are used to designate Greek and Roman provinces).

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.15 **Syria.**
.16 **Egypt and North Africa** (Coptic).
723.2 **BYZANTINE.**
.245 **Italy.**
.247 **Russia.**
.2495 **Greece.**
.2496 **Constantinople and Vicinity.**
.2497 **Balkans.**
723.3 **MOHAMMEDAN OR SARACENIC.**
.346 **Spain** (Moorish).
.353 **Arabia.**
.3539 **Syria.**

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.354 **India.**
.355 **Persia.**
.356 **Turkey.**
.362 **Egypt.**
.363 **North Africa** (Moorish).
723.4 **ROMANESQUE.**
.441 **Ireland and Scotland** (Celtic).
.442 **England.**
.4421 Saxon.
.4422 Norman.
.443 **Germanic Countries** (Rhenish).
.444 **France.**
.4441 Provencal.
.4442 Aquitainian.
.4443 Auvergnat.
.4445 Cluniac or Burgundian.
.4446 Norman.
.445 **Italy.**
.4451 Lombard.
.4452 Central.
4453 Siculo-Arabic.
.446 **Spain and Portugal** (Iberian Peninsula).
.447 **Russia.**
.448 **Scandinavia.**
.4481 Norway.
.4482 Sweden.
.4483 Denmark.
.449 **Minor Countries.**
723.5 **GOTHIC.**
.541 **Ireland and Scotland.**
.542 **England.**
.5421 Early English, 1175-1307 (13th C.)
.5422 Decorated, 1307-1377 (14th C.)
.5423 Perpendicular, 1377-1485 (15 C.)
.5424 Tudor, 1485-1558 (Early 16th C.)
.5421 or { Lancet. / Geometrical (13th and 14th C.) / Curvilinear.
.5422 Rectilinear (15th C.)
.5423 Tudor (Early 15th C)
.543 **Germanic Countries.**
.544 **France.**
.5441 Primary or Gothique (13th C.)
.5442 Secondary or Rayonnant (14th C.)
.5443 Tertiary or Flamboyant (15th C.)
.545 **Italy.**
.546 **Spain and Portugal** (Iberian Peninsula).
.547 **Russia.**
.548 **Scandinavian Countries.**
.549 **Minor Countries.**

724 MODERN.

724.1 **RENAISSANCE.**
.141 **Ireland and Scotland.**
.142 **England.**
.1421 Elizabethan.
.1422 Jacobean.
.1423 Queen Ann.
.1424 Georgian.
.143 **Germanic Countries.**
.144 **France.**
.1441 Valois Period. { Transition. / Francis I. / Advanced Renaissance.
.1442 Bourbon. { Henri IV. / Louis XIV. / Rococo.
.1443 Louis XVI.
.1444 Empire.
.145 **Italy.**
.1451 Early.
.1452 High.
.1453 Baroque.
.146 **Iberian Peninsula** (Spain and Portugal).
.147 **Russia.**
.148 **Scandinavian Countries.**
.149 **Minor Countries.**
.172 **Spanish Colonial** (Mission Mexico.)
.1721 California.
.1722 New Mexico.
.1723 Arizona.
.1724 Texas.
.1725 Florida (Arbitrary numbers given for geographical divisions).

724

.173 **American Colonial** (Including Georgian).
.1731 English (1607-1720).
.17311 New England.
.17312 New York and Middle States.
.17313 Maryland, Virginia, S. Carolina (Georgian Period).
.1723 Dutch (1720-1800).
.17321 New York.
.17322 Pennsylvania.
.1733 Swedish.
.17331 Pennsylvania.
.17332 New Jersey.
.1734 French.
.17341 Canada.
.17342 Mississippi Valley.

724.2 **CLASSIC REVIVAL** (Roman and Greek).
.241 **Ireland and Scotland.**
.242 **England.**
.243 **Germany.**
.244 **France.**
.245 **Italy.**
.246 **Spain.**
.247 **Russia.**
.248 **Scandinavian Peninsula.**
.249 **Minor Countries.**
.271 **United States** (1800-1850).

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724.3 **GOTHIC REVIVAL.**
.341 **Ireland and Scotland,** etc.
.373 **United States.**

724.4 **ROMANESQUE REVIVAL.**
.441 **Ireland and Scotland,** etc.
.473 **United States.**

724.5 **MODERNIST SCHOOL.**
.541 **Ireland and Scotland.**
.542 **England.**
.543 **Germany and Austria** (Secession Movement).
.544 **France** (Art Nouveau).
.545 **Italy,** etc.
.573 **United States** (Functionalism).
.6
.7
.8

724.9 **CONTEMPORARY TYPES.**
.941 **Ireland and Scotland,** etc.
.973 **United States.**
.9731 French Renaissance Vogue.
.9732 Neo-Romanesque Vogue.
.9733 Neo-Classic Vogue.
.9734 Neo-Gothic Vogue.
.9735 Spanish Vogue.
.9736 Italian Vogue.

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These numbers are added to the various styles in order to designate geographical distribution.

4 EUROPE.
41 Ireland and Scotland.
42 England.
43 Germany.
431 Austria.
44 France.
45 Italy.
46 Spain.
47 Russia.
48 Scandinavian Countries.
49 Minor Countries.
5 ASIA.
6 AFRICA.
7 NORTH AMERICA.
71 Canada.
72 Mexico.
73 United States.

725 **PUBLIC BUILDINGS.**
.1 **Administrative. Governmental.**
.11 Capitols. Houses of Parliament.
.12 Ministries of War, State, etc.
.13 City and Town Halls. Bureaus. Public Offices. City Plans.
.14 Custom Houses. Bonded Warehouses. Excise Offices.
.15 Court Houses. Record Offices.
.16 Post Offices, General and Special.

725
.17 Official Residences. Palaces of Rulers.
.18 Barracks. Armories. Police Stations.
.19 Engine Houses. Fire Alarm Stations.

725.2 **Business and Commercial.**
.21 Stores, Wholesale and Retail.
.22 Mixed Store, Office, and Apartment Buildings.
.23 Office Buildings. Telegraph. Insurance. Loft.
.24 Banks. Safe Deposit. Savings.
.25 Exchanges. Boards of Trade.
.26 Markets.
.27 Cattle Markets. Stock Yards.
.28 Abattoirs, Meat Packing Plants, etc.
.29 Other Business Buildings.

725.3 **Transportation and Storage.**
.31 Railway Passenger Stations.
.32 Railway Freight Houses.
.33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.
.34 Dock Buildings. Wharf Boats and Houses.
.35 1, Warehouses; 2, Cold Storage; 3, Safe Deposit Storage.
.36 Elevators, Grain.
.37
.38
.39 Other.

725.4 **Manufactories.**
.41 Textile Factories or Mills. Wool. Cotton, Silk.
.42 Breweries. Malteries. Distilleries.
.43 Foundries. Machine Shops. Iron and Steel Works.
.44 Wood-working Mills, Furniture, Piano and Organ Factories.
.45 Carriage and Car Factories.
.46 Paper Mills.
.47 Mills for Flour, Meal, Feed, etc.
.48 Pottery, Glass, Terra Cotta, Brick Works.
.49 Other Manufactories.

725.5 **Hospitals and Asylums.** See also 725.6. Reformatories.
.51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.
.52 Insane.
.53 Idiotic. Feeble-minded.
.54 Blind. Deaf and Dumb.
.55 Paupers. Almshouses.
.56 Aged.
.57 Children. Orphans.
.58 Foundling.
.59 Soldiers' Homes.

725.6 **Prisons and Reformatories.**
.61 State Prisons. Penitentiaries.
.62 Jails. Cell Houses.
.63 Reformatories for Adults. Houses of Correction.
.64 Reform Schools.
.65 Inebriate Asylums.

725.7 **Refreshment. Baths. Parks.**
.71 Cafés. Restaurants.
.72 Saloons.
.73 Baths: Warm, Medicated, Turkish, Russian.
.74 Swimming Baths.
.75 Buildings for Watering Places, Spas, etc.
.76 Buildings for Parks and Streets, Public Comfort Stations.

725.8 **Recreation.**
.81 Music Halls Auditoriums.
.82 Theatres. Opera Houses.
.83 Halls for Lectures, Readings, etc.
.84 Bowling Alleys. Billiard Saloons.
.85 Gymnasiums. Turn Halls.
.86 Skating Rinks. Bicycle Rinks.
.87 Boat Houses. Bath Houses.
.88 Riding Halls and Schools.
.89 Shooting Galleries.

725.9 **Other Public Buildings.**
.91 Exhibition Halls.
.92 Temporary Halls. Tabernacles. Wigwams.

727

.93 Workingmen's Clubs and Institutes.
.94 Town Squares.
.95 Summer Recuperating Camps.

726 **ECCLESIASTICAL AND RELIGIOUS.**

.1 **Temples.**
.2 **Mosques.**
.3 **Synagogues.**
.4 **Chapels. Sunday-school Buildings.**
.5 **Churches.**
.51 Frame.
.52 Brick or Stone.
.521 Small Audt., seating less than 600.
.522 Large Audt., seating more than 600.
.6 **Cathedrals.**
.7 **Monasteries. Convents. Abbeys.**
.8 **Mortuary. Cemetery Chapels. Receiving Vaults. Tombs.**
.9 **Others, Y. M. C. A., etc.**

727 **EDUCATIONAL AND SCIENTIFIC.**

.1 **Schools.**
.11 Ward and Grammar.
.12 High Schools.
Study and Recitation Rooms. Not including dormitory or boarding.
.2 **Academies. Seminaries. Boarding Schools.**
.3 **Colleges. Universities.**
.4 **Professional and Technical Schools. Law, Theology, etc.**
.5 **Laboratories: Physical, Chemical.** See 542.1, **Biological, etc. Zoological and Botanic Gardens.** See also 590.7 and 580.7.
.6 **.1, Museums. .2, Herbariums.** See 580.7.
.7 **.1, Art Galleries. .2, Studios.**
.8 **Libraries.** See 022, Library Buildings.
.9 **Other. Learned Societies, etc.**

728 **RESIDENCES.**

.1 **Tenement Houses.**
.11 City Homes of Poor.
.12 Country Homes of Poor.
.13 Cités Ouvrieres.
728.2 **Collective Dwellings.**
.21 Flats; one family to the floor.
.211 Small Flats less than 8 rooms.
.212 Large Flats, 8 rooms or more.
.22 Apartment Houses; more than one family to floor.
.221 Five Suites or Less.
.222 Six Suites or More.
.2221 Elevator Service.
.2222 No Elevator Service.
728.3 **City Houses. Mansions. Palaces.**
.31 Between party-walls. Stone.
.32 Between party-walls. Brick.
.33 Between party-walls. Partly wood.
.34 Semi-detached, including end houses in city blocks. Stone.
.35 Semi-detached, including end houses in city blocks. Brick.
.36 Semi-detached, including end houses in city blocks. Partly wood.
.37 Detached. Stone.
.38 Detached. Brick.
.39 Detached. Partly wood.
728.4 **Club Houses. Buildings for Secret Societies.**
.5 **Hotels.**
.51 City Hotels.
.52 Summer Resorts.
.53 Country Inns.
728.6 **Village and Country Homes.**
.61 Village Dwellings. On small lots.
.62 Stone.
.63 Brick.
.64 Concrete or stucco.
.65 Part masonry, part wood.
.66 All wood, 1, less than 7 rooms, 2, 7-12 rm; 3, 13 rm or over.
.67 Farm Houses.
.68 Laborers' Cottages. 1, Frame; 2, Masonry.
728.7 **Seaside and Mountain Cottages.**

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728.8 **Country Seats.**
.81 Castles.
.82 Chateux.
.83 Manor Houses.
.84 Villas
.85 Log Houses.
.86 Bungalows.
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.98 Conservatories. Green Houses. Graperies.
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Kinnear Mfg. Co., 844 Rush St. 476
Shaw, E. L. & Co., 53 W. Jackson Blvd. 476
Variety Fire Door Co., 2958 Carroll Av. 474

FIRE ESCAPES.

Halsted, Joseph Co., 31st & Spaulding Av. 478
Johnson, Chas. & Son Fire Escape Co., 320 W. Grand 456
Standard Fire Escape Co., 23 S. Western 482
Union Fdry. Wks., 38 S. Dearborn St. 472

FIRE EXTINGUISHERS.

(See Sprinkler Systems)

FIRE WINDOWS.

Detroit Steel Prod. Co., 111 W. Wash. 410
Lupton, David, Sons Co., 28 E. Jackson 408
Shaw, E. L. & Co., 53 W. Jackson Bl. 476

FIREPLACES.

Colonial Fireplace Co., 4626 W. Roosevelt 28
Interior Tiling Co., 21 E. Van Buren 430
Jackson, Wm. H. Co., 318 N. Michigan 432
McWayne Co., 639 N. Wells St. 430
Nat. Tile Co., 59 E. Adams 432
Rees Tile Co., 4406 N. Clark St. 420
Updike & Co., 230 E. Ohio St. 418

FIREPROOF PARTITIONS.

Continental Fireproofing Co., 220 S. State 486
Ill. Fireproof Constr. Co., 209 S. La Salle 484
Nat. Fireproofing Co., 2610 Shields Av. 486
Simplex Steel Prod. Co., 1146 Roscoe St. 664
U. S. Gypsum Co., 205 W. Monroe St. 40

FIREPROOF SHUTTERS AND DOORS.

(See Iron Doors & Shutters)

FIREPROOFING.

Consolidated Exp. Metal Co., 1234 W. Wash. 34
Continental Fireproofing Co., 220 S. State 486
Ill. Fireproof Constr. Co., 209 S. La Salle 484
Nat. Fireproofing Co., 2610 Shields Av. 486
U. S. Gypsum Co., 205 W. Monroe St. 40

FIXTURES—STEEL.

Durand Steel Locker Co., 76 W. Monroe 18
Federal Steel Fixture Co., 4545 Homer 56

FLOOR COVERINGS.

Hardwick & McGee Co., 29 E. Madison St. Inside Front Cover

FLOOR DEADENING.

Hylonite Products Co., 1107 Addison St. 74
Wood Conversion Co., 310 S. Michigan 36

FLOOR DRAINS.

Wade Iron Sanitary Mfg. Co., 551 Fulton 614

FLOOR PLATES—WROUGHT IRON.

Castle, A. M. & Co., 1300 N. Branch 472
Scully Steel & Iron Co., 2364 S. Ashland 470

FLOORS—ACID PROOF.

Fulton Asphalt Co., 53 W. Jackson Blvd. 86
Moore, Edw. Roofing Co., 2729 W. Madison 70

FLOORS—ART MARBLE.

Chicago Art Marble Co., 2883 Hillock Av. 424
Nat. Mosaic Tile Co., 2901 S. Cicero Av. 426

FLOORS—ASPHALT.

Fulton Asphalt Co., 53 W. Jackson Blvd. 86
Moore, Edw. Roofing Co., 2729 W. Madison 70

FLOORS—CORK INSULATED.

United Cork Companies, 1151 Eddy St. 92

FLOORS—HARDWOOD.

Bishop Lumber Co., 2315 Elston Av. 510
Burns Lumber Co., 700 W. Chicago Av. 502
De Vries, S. J. & Co., 840 W. 47th Pl. 504
Hines, Ed., Lumber Co., 2431 S. Lincoln 506
Rittenhouse & Embree Co., 3500 S. Racine 508

FLOORS—MAGNESIA COMPOSITION.

Moulding, Thos. Brick Co., 133 Washington 64
Muller, Franklin R., Inc., Waukegan, Ill. 1
Williams-Wendt Co., 118 N. La Salle St. 348

FLOORS—MOSAIC.

Am. Encaustic Tiling Co., 332 S. Michigan 412
Hawes & Dodd, 59 E. Adams St. 428
Hawkinson, John S. Co., 80 E. Jackson 428
Interior Tiling Co., 21 E. Van Buren St. 430
Jackson, Wm. H. Co., 318 N. Michigan 432
Lorenzen, Chas. F. Co., 521 W. Monroe 422
McWayne Co., 639 N. Wells St. 430
Mosaic Tile Co., Kimball Bldg. 414
Nat. Tile Co., 59 E. Adams 432
Novak Mosaic Co., 101 S. Sangamon St. 434
Rees Tile Co., 4406 N. Clark St. 420
Updike & Co., 230 E. Ohio St. 418

FLOORS—RUBBER TILE.

Salisbury, H. W. & Co., Inc., 308 W. Madison St. 80
Wright Rubber Products Co., Racine, Wis. 78

FLOORS—WOOD BLOCK.

Dodge, H. B. & Co., 332 S. Michigan Av. 351
Indiana Wood Preserving Co., 111 W. Washington 52

FLUE LININGS.

Am. Terra Cotta & Ceramic Co., 1701 Prairie Av. 60
Continental Fireproofing Co., 220 S. State 486
Dee, Wm. E. Co., 30 N. La Salle St. 488
Ill. Fireproof Constr. Co., 209 S. La Salle 484
Midland Terra Cotta Co., 105 W. Monroe 30
Nat. Fire-Proofing Co., 2610 Shields Av. 486
Northwestern Terra Cotta Co., 2525 Clybourn Av. 10

FORGINGS.

American Bridge Co., 208 S. La Salle 436
McClintic-Marshall Co., 38 S. Dearborn 440

FOUNDATIONS.

B. & A. Co., 53 W. Jackson Blvd. 332

FOUNDRIES.

Ill. Malleable Iron Co., 1801 Diversey 578
Union Foundry Works, 38 S. Dearborn 472

FURNACES.

Chicago Down Draft Furnace Co., 115 S. Clinton St. 554

FURNITURE, SPECIAL DESIGN.

Nelson, W. P. Co., 614 S. Michigan Av. 642
Plamondon & Gabriel Co., 308 N. Michigan 640

FUSE RENEWABLE.

Benjamin Elec. Mfg. Co., 847 W. Jackson 354
Chgo. Fuse Mfg. Co., 1501 W. 15th St. 360
Economy Fuse & Mfg. Co., 2711 Greenview Av. 356

GARAGE DRAINS.

Wade Iron Sanitary Mfg. Co., 551 Fulton 614

GARBAGE CREMATORIES.

Goder Incinerator Co., 320 E. N. Water 542
Kerner Incinerator Co., Tribune Tower 526
Kewanee Boiler Co., 820 W. Washington 524
Weil-McLain Co., 641 W. Lake St. 528

GAS APPLIANCES.

Peoples Gas Light & Coke Co., 122 S. Michigan 400-402

GAS FIXTURES.

Everson, C. G. & Co., 70 W. Lake St. 364
Peoples Gas Light & Coke Co., 122 S. Michigan 400-402

GAS FITTING.

(See Plumbing, Gas Fitting and Sewerage)

GAS—ILLUMINATING.

Peoples Gas Light & Coke Co., 122 S. Michigan 400-402

GAS LOGS AND GAS GRATES.

Colonial Fireplace Co., 4626 W. Roosevelt 28
Pearlman, Victor S. & Co., 533 S. Wabash 352
Peoples Gas Light & Coke Co., 122 S. Michigan 400-402

GAS RANGES AND STOVES.

Cribben & Sexton Co., 600 N. Sacramento 404
Janows & Kramer Co., 1637 Carroll Av. 350
Peoples Gas Light & Coke Co., 122 S. Michigan 400-402
Pick, Albert & Co., 212 W. Randolph St. 66

GENERAL CONTRACTORS.

Anderson, A. & E. Co., 19 S. La Salle 336
Anderson, Edward A. Co., 8 E. Huron St. 339
Ardmore Const. Co., 105 W. Monroe St. 326
Arquette, Geo. L. & Co., 160 N. La Salle 162
Barnard, H. B., 140 S. Dearborn St. 140
Behrens, N. H. & Co., 1939 Milwaukee Av. 341
Black, Robert Co., 122 S. Michigan Av. 302
Brundage, Avery, 110 S. Dearborn St. 138
Bully & Andrews, 2040 W. Harrison St. 312
B. & A. Co., 53 W. Jackson Blvd. 332
Cadenhead Co., 8 E. Huron St. 339
Clark, C. Everett Co., 69 W. Washington 156
Dahl-Stedman Co., 11 S. La Salle St. 148
Duffy Noonan Constr. Co., 140 S. Dearborn 306
Duval Herrling & Co., 190 N. State St. 328
Ericsson, Henry Co., 139 N. Clark St. 146
Ford & Phillip Co., 559 W. Van Buren St. 341
French, J. B. Co., 30 N. Michigan Av. 314
Friestedt, H. F. Co., 435 N. Michigan Av. 322
Gage, Thos. G. Co., 64 W. Randolph St. 310
Griffiths, John & Son Co., 112 W. Adams 130
Hallbauer & La Bahn, Inc., 844 Rush St. 298
Hanson Bros. Co., 127 N. Dearborn 340
Husak & Root, 833 N. California Av. 296
Janisch, H. & Co., 1801 Winona St. 304
Lanquist Co., 1100 N. Clark St. 136
Larson, Algot B. Co., 19 S. La Salle St. 166
Maas-Manson Co., 20 W. Jackson Blvd. 164
McKeown Bros. Co., 112 W. Adams St. 152
McLennan Constr. Co., 360 N. Michigan 300
McNulty, Wm. G. & Bro., 58 E. Washing. 316
Mellon-Stuart Co., 111 W. Washington 318
Meyne, Gerhardt F., 127 N. Dearborn St. 337
Moreland, H. D. Co., 3701 Sheffield Av. 324
Moses, C. A. Constr. Co., 133 W. Wash. 144
Nielson, S. N. Co., 3059 Augusta St. 337
Rasmussen, C., 77 W. Washington St. 340
Rauen, Math Co., 326 W. Madison St. 308
Seipp & Lonergan, 179 W. Washington 158
Shedden, James & Co., 106 N. La Salle 338
Simmons-Dick Co., 549 Washington Blvd. 292
Snyder, J. W. Co., 116 S. Michigan Av. 132
Sollitt, Ralph & Sons Constr. Co., 5 N. La Salle St. 336
Starrett-Dilks Co., 160 N. La Salle St. 154
Strandberg Bros., 608 S. Dearborn 320
Strandberg, E. P. Co., 232 E. Ohio St. 160
Thielberg, A. C., 64 W. Randolph St. 338
Thompson-Starrett Co., 104 S. Michigan 134
Thomson, Geo. & Son Co., 30 N. La Salle 150
Turner Constr. Co., 6 N. Michigan Av. 294
Wells Bros. Constr. Co., 53 W. Jackson 142
Wilson, R. F. & Co., 1851 Elston Av. 128

GLASS AND GLAZING.

Hamilton Glass Co., 415 N. Elizabeth St. 660
Hooker, H. M. Glass & Paint Co., 651 W. Washington 662
Sharp Partridge & Co., 2263 Lumber St. 656

GLASS—PRISMATIC.

Am. 3 Way-Luxfer Prism Co., Cicero, Ill. 38 & 654
Hamilton Glass Co., 415 N. Elizabeth St. 660
Hooker, H. M. Glass & Paint Co., 651 W. Washington 662
Sharp, Partridge & Co., 2263 Lumber St. 656

GLASS—WIRE.

Mississippi Wire Glass Co., 360 N. Mich. 650

GRAIN ELEVATOR MACHINERY.

Kaestner & Hecht Co., 1500 N. Branch St. 100
Link-Belt Co., 300 W. Pershing Rd. 114
Olson, Samuel & Co., 2418 Bloomingdale 14
Weller Mfg. Co., 1820 N. Kostner Av. 108

GRATES AND FIREPLACES.

Colonial Fireplace Co., 4626 W. Roosevelt 28
Updike & Co., 230 E. Ohio St. 418

GRAVEL.

Consumers Co., 111 W. Washington 116
Dee, Wm. E. Co., 30 N. La Salle St. 488

GREASE TRAPS.

Wade Iron Sanitary Mfg. Co., 551 Fulton 614

GRILLE WORK—METAL.

(See Iron Work—Ornamental)

GYPSUM PRODUCTS.

U. S. Gypsum Co., 205 W. Monroe St. 40

HANGERS AND SHAFTING.

Scully Steel & Iron Co., 2364 S. Ashland 470

HARDWARE—BUILDERS.

Cobb, Whyte & Laemmer Co., 309 W. Madison 346
Gardner-Vail, Inc., 566 Washington Bl. 512
Midwest Hardware Co., 56 W. Randolph 58

HARDWOOD FLOORING.

(See Flooring—Hardwood)

HAULING CONTRACTORS.

Pennoyer Merchants Transfer Co., 742 W. Polk St. 110

HEAT REGULATION.

Johnson Service Co., 1355 Washington 578

HEATERS—OIL.

Hardinge Bros., Inc., 1720 S. Michigan 548
Winslow Boiler & Eng. Co., 175 N. Mich. 550

HEATING APPARATUS.

Am. Radiator Co., 820 S. Michigan Av. 538
Chicago Down Draft Furnace Co., 115 S. Clinton St. 554
Clow, Jas. B. & Sons, Lake, Talman & Fulton 594
Ferguson & Lange Fdry. Co., 1039 Willow 544
Hardinge Fuel Oil Htg. Co., 1720 S. Michigan 548
Ill. Malleable Iron Co., 1801 Diversey 578
Kellogg Mackay Co., 419 W. 18th St. 522
Kewanee Boiler Co., 820 W. Washington 524
Weil-McLain Co., 641 W. Lake St. 528
Winslow Boiler & Eng. Co., 175 N. Mich. 550

HEATING CONTRACTORS—HOT WATER—STEAM—VACUUM—VAPOR.

Am. Heat. & Plumbing Co., 189 N. Clark 568
Arcade Steam Heat. Co., 126 W. Kinzie 558
Claffey, E. J. Co., 10 W. Illinois St. 575
Crane, M. H. Estate, 28 N. Desplaines St. 576
Douglass, Thos. J. & Co., 352 Whiting St. 566
Gallaher & Speck, 215 W. Congress St. 572
Glennon-Bielke Co., 546 W. Lake St. 571
Gordon, Robt. Inc., 22 W. Austin Av. 564
Graves, W. B. Heating Co., 162 N. Desplaines 569
Hanley & Co., 6 N. Clark St. 622
Henrich, Geo. A. Co., 702 N. Wells St. 556
Herlihy, J. J., 810 W. Congress St. 574
Hoier, Wm. V. Co., 701 N. Wells St. 562
Johnson, C. W., Inc., 211 N. Desplaines 560
Kehm Bros. Co., 51 E. Grand Av. 574
Kilander, A. & Co., 126 S. Clinton St. 570
Kirk, Geo. H., 6711 Wentworth Av. 573
Kohlbry, Howlett Co., 63 W. Ontario St. 576
Lees, Wm., 548 Washington Bl. 575
Mehring & Hanson Co., 162 N. Clinton St. 568
Nilson Bros., 3222 N. Halsted St. 572
Noble & Thumm, 1065 Addison St. 624
Phillips, Getschow Co., 128 W. Kinzie 571
Pope, Wm. A., 26 N. Jefferson St. 570
Rigby, Ben., Inc., 604 W. Lake St. 569
Wendt & Crone Co., 1131 N. Wells St. 582

HECTOGRAPH PRINTS.

Crofoot, Nielsen & Co., 172 W. Wash. 343

HOISTING MACHINERY.

Sasgen Derrick Co., 3103 W. Grand Av. 112

HOLLOW TILE.

Continental Fireproofing Co., 220 S. State 486
Dee, Wm. E. Co., 30 N. La Salle St. 488
Ill. Fireproof Constr. Co., 209 S. La Salle 484
Nat. Fire-Proofing Co., 2610 Shields Av. 486

HOT BLAST HEATING.

Haines Co., 1920 W. Lake St. 587
Hayward, R. B. Co., 1714 Sheffield Av. 573
Monarch Vent. Co., 1338 Sedgwick St. 586
Narowetz Heat. & Vent. Co., 1711 Park 580
Wendt & Crone Co., 1131 N. Wells St. 582

HOT WATER HEATERS.

Humphrey Co., 916 S. Michigan Blvd. 579
Ill. Malleable Iron Co., 1801 Diversey 578
Kewanee Boiler Co., 820 W. Washington 524

HOTEL SUPPLIES.

Janows & Kramer Co., 1637 Carroll Av. 350
Pick, Albert & Co., 212 W. Randolph 66

HOUSE MOVERS AND RAISERS.

Friestedt, L. P. Co., 7 S. Dearborn St. 330

HUMIDIFIERS.

Art Metal Radiator Cover Co., 1730 N. Kolmar Av. 552

HYDRANTS.

Chgo. Faucet Co., 2712 N. Crawford Av. 610
Crane Co., 836 S. Michigan Av. 534 & 600

HYDRAULIC ELEVATORS.

(See Elevators, Passenger and Freight)

ICE CONVEYING MACHINERY.

Olson, Samuel & Co., 2418 Bloomingdale 14
Link-Belt Co., 300 W. Pershing Rd. 114
Weller Mfg. Co., 1820 N. Kostner Av. 108

INCINERATORS—GARBAGE.

Goder Incinerator Co., 320 E. North Water 542
Kerner Incinerator Co., Tribune Tower 526
Kewanee Boiler Co., 820 W. Washington 524
Weil-McLain Co., 641 W. Lake St. 528

INDIANA LIMESTONE.

Cent. Oolitic Stone Co., 2126 S. Kedzie 494
Hoadley, J. & Sons Co., Bloomingdale, Ill. 496
Indiana Quarries Co., 112 W. Adams St. 490
McMillan, Wm. Sons, 10 S. La Salle St. 492

INDUCED DRAFT REGULATORS.

Davis, G. M. Reg. Co., 428 Milwaukee 577

INDUSTRIAL LIGHTING.

Beardslee Chandelier Mfg. Co., 216 S. Jefferson 372
Benjamin Elec. Mfg. Co., 847 W. Jackson 354
Central Electric Co., 320 S. Wells St. 358
Commonwealth Edison Co., 72 W. Adams 378
Everson, C. G. & Co., 70 W. Lake St. 364
Frink, I. P., Inc., 53 W. Jackson Blvd. 362
Harter Mfg. Co., 1850 Fulton St. 370
Herwig Co., 1753 Sedgwick St. 366
Overbagh & Ayres, 411 S. Clinton St. 368
Pearlman, Victor S. & Co., 533 S. Wabash 352

INSPECTORS.

Hunt, Robt. W. Co., Ins. Exch. Bldg. 62

INSULATION.

Bird & Son, 1472 W. 76th St. 22
Cent. Asbestos & Mag. Co., 214 W. Grand 518
Johns-Manville, Inc., 18th & Michigan 8
Krez, Paul J. Co., 444 No. La Salle St. 516
Luse-Stevenson Co., 307 N. Michigan 54
Standard Asbestos Mfg. Co., 820 W. Lake 520
United Cork Companies, 1151 Eddy St. 92
Wood Conversion Co., 310 S. Michigan 36

INSULATING MATERIALS.

Bird & Son, 1472 W. 76th St. 22
Johns-Manville, Inc., 18th & Michigan 8
United Cork Companies, 1151 Eddy St. 92
Wood Conversion Co., 310 S. Michigan 36

INTERIOR FINISH.

Anderson & Lind Mfg. Co., 2127 Iowa St. 48
Baumann, Poe Mfg. Co., 1501 Smith 44
Chicago Sash, Door, & Blind Mfg. Co., 1249 W. North Ave. 50
Edmunds Mfg. Co., 2016 Washburne Av. 46
Johnson-Schweizer Co., 1249 W. North 50
Matthews Bros. Mfg. Co., Milwaukee, Wis. 752
West Woodworking Co., 310 N. Ada St. 42

IRON DOORS AND SHUTTERS.

Am. Architectural Iron Wks., 2257 St. Paul Av. 464
Cent. Ornamental Iron Wks., 157 Wendell St. 483
Coleman, Adelbert E., 37th & Stewart Av. 470
Guaranty Iron & Steel Co., 3847 W. Lake 454
Halsted, Joseph Co., 31st & Spaulding Av. 478
Hill, O. H. Co., 2253 St. Paul Av. 444
Ill. Malleable Iron Co., 1801 Diversey 577
Kinnear Mfg. Co., 844 Rush St. 476
Manton Smith Co., 3333 W. Grand Av. 458
Shaw, L. E. & Co., 53 W. Jackson Blvd. 476
Variety Fire Door Co., 2958 Carroll Av. 474
Western Arch'l Iron Co., 211 W. Schiller 466
Western Iron Constr. Co., 4906 N. Clark 482
Wetzel Iron Wks., 3346 W. Grand Av. 462
Weymer, E. M. Co., 2820 W. Grand Av. 460

IRON STAIRS—RAILINGS AND FENCES.

(See Architectural Iron & Bronze)

IRON STORE FRONTS.

(See Architectural Iron Work)

IRON WORK—ORNAMENTAL.

Am. Architectural Iron Wks., 2257 St. Paul Av. 464
Bolters, A. Sons, 2301 Ward St. 480
Cent. Ornam'l Iron Wks., 157 Wendell 483
Coleman, Adelbert E., 37th & Stewart Av. 470
Duffin Iron Co., 4837 S. Kedzie Av. 442
Federal Iron Works, 30 N. La Salle St. 480
Guaranty Iron & Steel Co., 3847 W. Lake 454
Halsted, Joseph Co., 31st & Spaulding Av. 478

Manton & Smith Co., 3333 W. Grand Av. 458
Simpson-Frisch Co., 1401 Wabansia Av. 483
Sullivan-Korber Co., 2437 W. 21st Pl. 478
Union Fdry. Wks., 38 S. Dearborn St. 472
Western Arch'l Iron Co., 211 W. Schiller 466
Western Iron Const. Co., 4906 N. Clark 482
Wetzel Iron Wks., 3346 W. Grand Av. 462
Weymer, E. M. Co., 2820 W. Grand Av. 460
Woodbridge Ornt'l. Iron Co., 1519 Altgeld St. 446-447

IRON WORK—STRUCTURAL.

(See Structural Iron and Steel)

IRONING BOARD CABINETS.

Majestic Steel Cabinet Co., 4229 Belle Plaine Av. 4
Wasmuth Endicott Co., Anderson, Ind., and Furniture Mart, Chicago 406

IRONING MACHINES (ELECTRIC)

Am. Laundry Mchy. Co., 633 S. Wabash 118
Commonwealth Edison Co., 72 W. Adams 378

JOISTS—STEEL.

Massillon Steel Joist Co., 208 S. La Salle 452

KALSOMINE.

Moore, Benj. & Co., 415 N. Green St. 638

KITCHENS—BUILTIN.

Majestic Steel Cabinet Co., 4229 Belle Plaine Av. 4
Wasmuth Endicott Co., Anderson, Ind., and Furniture Mart, Chicago 406

KITCHENS—STEEL.

Janows & Kramer Co., 1637 Carroll Av. 350
Majestic Steel Cabinet Co., 4229 Belle Plaine Av. 4

LABORATORY EQUIPMENT.

Alberene Stone Co., 1700 Elston Av. 579

LABORATORY—TESTING.

Hunt, Robt. W. Co., Inc., Exch. Bldg. 62

LAMPS, EXTERIOR—IRON AND BRONZE.

Am. Architectural Iron Wks., 2257 St. Paul Av. 464
Beardslee Chandelier Mfg. Co., 216 S. Jefferson 372
Cent. Ornamental Iron Wks., 157 Wendell 483
Coleman, Adelbert E., 37th & Stewart 470
Everson, C. G. & Co., 70 W. Lake St. 364
Frink, I. P., Inc., 53 W. Jackson Blvd. 362
Halsted, Joseph Co., 31st & Spaulding Av. 478
Harter Mfg. Co., 1850 Fulton St. 370
Herwig Co., 1753 Sedgwick St. 366
Manton & Smith Co., 3333 W. Grand Av. 458
Overbagh & Ayres Mfg. Co., 411 S. Clinton St. 368
Sullivan-Korber Co., 2437 W. 21st Pl. 478
Western Arch'l Iron Co., 211 W. Schiller 466
Wetzel Iron Wks., 3346 W. Grand Ave. 462
Weymer, E. M. Co., 2820 W. Grand Av. 460
Woodbridge, Ornt'l. Iron Co., 1519 Altgeld St. 446-447

LATH.

Bishop Lumber Co., 2315 Lincoln Av. 510
Burns Lumber Co., 700 W. Chicago Av. 502
DeVries, S. J. & Co., 840 W. 47th Pl. 504
Hines, Ed. Lumber Co., 2431 S. Lincoln 506
Rittenhouse & Embree Co., 3500 S. Racine 508

LATH—METAL AND WIRE.

Concr. Engineering Co., 1926 S. 52nd Av. 448
Consol't'd Exp. Metal Co., 1234 W. Wash. 34
Voss, Frederick, 552 W. Monroe St. 677

LAUNDRY MACHINERY.

Am. Laundry Mchy. Co., 633 S. Wabash 118

LAUNDRY TRAYS AND KITCHEN SINKS.

Alberene Stone Co., 1700 Elston Av. 579
Am. Laundry Mchy. Co., 633 S. Wabash 118
Clow, Jas. B. & Sons, Lake, Talman & Fulton 594
Crane Co., 836 S. Michigan Av. 534 & 600
Kellogg Mackay Co., 419 W. 18th St. 522
Kohler Co., 431 N. Michigan Ave. 598
Standard Sanitary Mfg. Co., 3700 Iron St. 596
Weil-McLain Co., 641 W. Lake St. 528
Wolff Mfg. Co., 225 N. Hoyne Ave. 592

LIABILITY INSURANCE.

Builders & Mfrs. Mutual Casualty Co., 133 W. Washington St. 24

LIGHT POSTS FOR STREET LIGHTING.

Am. Concrete Products Co., 30 N. La Salle 398

LIGHTING FIXTURES.

(See Electric Fixtures)

LIGHTNING RODS.

Arrow Conductor Co., 1536 W. Adams 474

LOCKERS—METAL.

Dodge, H. B. & Co., 332 S. Michigan Av. 351
Durand Steel Locker Co., 76 W. Monroe St. 1
Federal Steel Fixture Co., 4545 Homer 56

LUMBER.

Bishop Lumber Co., 2315 Lincoln Av. 510
Burns Lumber Co., 700 W. Chicago Av. 502
DeVries, S. J. & Co., 840 W. 47th Pl. 504
Hines, Ed. Lumber Co., 2431 S. Lincoln 506
Rittenhouse & Embree Co., 3500 S. Racine 508

LUMBER—TIES—PILING CREOSOTED.

Indiana Wood Preserving Co., 111 W. Washington 52

MACHINERY ERECTORS, MOVERS AND RIGGERS.

Pennoyer Merchants Transfer Co., 742 W. Polk St. 110

MACHINISTS.

Gallaher & Speck, 215 W. Congress St. 572

MAGNESIA PRODUCTS.

Cent. Asbestos & Mag. Co., 214 W. Grand 518
Johns-Manville, Inc., 18th & Michigan 8
Krez, Paul J. Co., 444 N. La Salle St. 516
Standard Asbestos Mfg. Co., 816 W. Lake 520

MAIL CHUTES.

Cutler Mail Chute Co., Rochester, N. Y. 350

MANHOLE COVERS.

Dee, Wm. E. Co., 30 N. La Salle St. 488
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

MANTELS.

Colonial Fireplace Co., 4626 W. Roosevelt 28
Peerling Marble Co., 2891 Hillock Av. Inside Back Cover
Updike & Co., 230 E. Ohio St. 418

MARBLE—ARTIFICIAL.

Cousins, H. A., Inc., Straus Bldg. 670
Kalteux, Nic., 218 E. Wabash Av. 434

MARBLE CONTRACTOR AND DEALER

Peerling Marble Co., 2891 Hillock Av. Inside Back Cover

MARBLE TRIM—HARDWARE.

Gardner-Vail, Inc., 566 Washington Blvd. 512

MASON CONTRACTORS.

Anderson, A. & E. Co., 19 So. La Salle 336
Anderson, Edward A. Co., 8 E. Huron St. 339
Ardmore Constr. Co., 105 W. Monroe St. 326
Arquette, Geo. L. & Co., 160 N. La Salle 162
Barnard, H. B. Co., 140 S. Dearborn St. 140
Behrens, N. H. & Co., 1939 Milwaukee Av. 341
Black, Robt. Co., 122 S. Michigan Av. 302
B. & A. Co., 53 W. Jackson Blvd. 332
Brundage, Avery, 110 S. Dearborn St. 138
Bulley & Andrews, 2040 W. Harrison St. 312
Cadenhead Co., 8 E. Huron St. 339
Clark, C. Everett Co., 69 W. Washington 156
Dahl-Stedman Co., 11 S. La Salle St. 148
Duffy-Noonan Constr. Co., 140 S. Dearborn 306
Duval, Herrling Co., 190 N. State St. 328
Ericcson, Henry Co., 139 N. Clark St. 146
Ford & Phillip Co., 559 W. Van Buren St. 341
French, J. B. Co., 30 N. Michigan Av. 314
Friestedt, H. F. Co., 435 N. Michigan Av. 322
Gage, Thos. G. Co., 64 W. Randolph St. 310
Griffiths, John & Son Co., 112 W. Adams 130
Hallbauer & La Bahn, Inc., 844 Rush St. 298
Hanson Bros. Co., 127 N. Dearborn St. 340
Husak & Root, 833 N. California Av. 296
Janisch, H. & Co., 1801 Winona St. 304
Lanquist Co., 1100 N. Clark St. 136

Larson, Algot B. Co., 19 S. La Salle St. 166
Maas-Manson Co., 20 W. Jackson Blvd. 164
McKeown Bros. Co., 112 W. Adams St. 152
McLennan Constr. Co., 400 N. Michigan 300
McNulty, Wm. G. & Bro., 58 E. Wash. 316
Mellon-Stuart Co., 111 W. Washington 318
Meyne, Gerhardt F., 127 Dearborn St. 337
Moreland, H. D. Co., 3701 Sheffield Av. 324
Moses, C. A. Constr. Co., 133 W. Wash. 144
Nielsen, S. N. Co., 3059 Augusta St. 337
Rasmussen, C., 77 W. Washington St. 348
Rauen, Math. Co., 326 W. Madison St. 308
Seipp & Lonergan, 179 W. Washington 158
Shedden, James & Co., 106 N. La Salle 338
Simmons, Dick Co., 549 Washington Blvd. 292
Sollitt, Ralph, & Sons Construction Co., 5 N. La Salle St. 336
Snyder, J. W. Co., 116 S. Michigan Av. 132
Starrett-Dilks Co., 160 N. La Salle St. 154
Strandberg Bros., 608 S. Dearborn St. 320
Strandberg, E. P. Co., 232 E. Ohio St. 160
Thielberg, A. C., 64 W. Randolph St. 338
Thompson-Starrett Co., 104 S. Michigan 134
Thomson, Geo., & Son Co., 30 N. La Salle 150
Turner Constr. Co., 6 N. Michigan Av. 294
Wells Bros. Constr. Co., 53 W. Jackson 142
Wilson, R. F. & Co., 1851 Elston Av. 128

MATERIAL HOISTS.

Sasgen Derrick Co., 3103 W. Grand Av. 112

MAUSOLEUMS.

Blake, Chas. G. Co., 108 S. La Salle St. 500

MEDICINE CABINETS.

Am. Enameled Products Co., 2101 Indiana 604
Majestic Steel Cabinet Co., 4229 Belle Plaine Ave. 4
Morton Mfg. Co., 5133 W. Lake St. 124

METAL LATH.

Concrete Eng. Co., 1926 S. 52nd Av. 448
Consolid't'd Exp. Metal Co., 1234 W. Wash. 34
Voss, Frederick, 552 W. Monroe St. 677

METAL, SASH & FRAMES.

Biegler, Louis Co., 165 N. Curtis St. 587
Detroit Steel Prod. Co., 111 W. Wash. 410
Lupton, David Sons Co., 28 E. Jackson 408

MILL WORK.

Anderson & Lind Mfg. Co., 2127 Iowa St. 48
Baumann, Poe Mfg. Co., 1501 Smith 44
Chicago Sash Door & Blind Mfg. Co., 1249 W. North Av. 50
Curtis Door & Sash Co., 1414 S. Western 168
Edmunds Mfg. Co., 2016 Washburne Av. 46
Johnson-Schweizer Co., 1249 W. North 50
Matthews Bros. Mfg. Co., Milwaukee, Wis. 752

MONUMENTS AND HEADSTONES.

Blake, Chas. G. Co., 108 S. La Salle St. 500

MORTGAGE LOANS.

(See Loans—Building)

MOSAICS.

Am. Encaustic Tiling Co., 332 S. Michigan 412
Hawes & Dodd, 59 E. Adams St. 428
Hawkinson, John S. Co., 80 E. Jackson 428
Interior Tiling Co., 21 E. Van Buren St. 430
Jackson, Wm. H. Co., 318 N. Michigan 432
Lorenzen, Chas. F. & Co., 521 W. Monroe 422
McWayne Co., 639 N. Wells St. 430
Mosaic Tile Co., Kimball Bldg. 414
Nat. Tile Co., 59 E. Adams St. 432
Novak Mosaic Co., 2019 Walnut 434
Rees Tile Co., 4406 N. Clark St. 420
Updike & Co., 230 E. Ohio St. 418

MURAL DECORATIONS.

Nelson, W. P. Co., 614 S. Michigan Av. 642

NEEDLE BATH WATER MIXERS.

Hoffmann & Billings Mfg. Co., Milwaukee, Wis. 608

OFFICE FIXTURES.

(See Interior Finish)

OFFICE FIXTURES—STEEL.

Federal Steel Fixture Co., 4545 Homer 56

OIL BURNERS.

Hardinge Fuel Oil Htg. Co., 1720 S. Michigan 548
Winslow Boiler & Eng. Co., 175 N. Mich. 550

ORGANS.

Lyon & Healy, Inc., Jackson & Wabash 20

PACKAGE CONVEYORS.

Olson, Samuel & Co., 2418 Bloomingdale 14
Link-Belt Co., 300 W. Pershing Road 114
Weller Mfg. Co., 1820 N. Kostner Av. 108

PAINT—DAMP RESISTING.

Am. Tar Products Co., 208 S. La Salle 347
Ceresit Waterproofing Corp., 10 S. La Salle St. 348
Ohmlac Paint & Refining Co., 140 S. Dear. 346

PAINT—FIREPROOF.

Am. Tar Products Co., 208 S. La Salle 347
Johns-Manville, Inc., 18th & Michigan 8
Moore, Benj. & Co., 415 N. Green St. 638

PAINT—GRAPHITE.

Detroit Graphite Co., 208 S. La Salle St. 636

PAINT—IRON.

Am. Tar Products Co., 208 S. La Salle 347
Ceresit Waterproofing Corp., 10 S. La Salle St. 348
Detroit Graphite Co., 208 S. La Salle St. 636
Lucas, John & Co., 1362 W. 37th St. 634
Moore, Benj. & Co., 415 N. Green St. 638
Ohmlac Paint & Refining Co., 140 S. Dear. 346

PAINT—MIXED.

Berry Bros., Inc., 119 W. Grand Av. 662
Detroit Graphite Co., 208 S. La Salle St. 636
Devoe & Raynolds Co., 14 W. Lake St. 628
Hockaday Co., 1823 Carroll Av. 630
Hooker, H. M., Glass & Paint Co., 651 W. Washington Blvd. 662
Lucas, John & Co., 1362 W. 37th St. 634
Moore, Benj. & Co., 415 N. Green St. 638

PAINTING CONTRACTORS.

Nelson, W. P. Co., 614 S. Michigan Av. 642
Noelle, J. B. Co., 864 N. Franklin St. 648
Olson, Alfred Co., 4651 N. Clark St. 644
Plamondon & Gabriel Co., 308 N. Mich. 640
Rising Dec. Co., 527 S. Peoria St. 646

PANELBOARDS.

Berthold, Gus. Electr. Co., 555 W. Monroe 380
Electric Apparatus Co., 702 N. Halsted 376
Newgard, Henry & Co, 4603 Fullerton Av. 382

PARTITION & CEILING CONSTRUCTION.

Simplex Steel Prod. Co., 1146 Roscoe St. 664

PARTITION AND FLOOR DEADENING.

Bird & Son, 1472 W. 76th St. 22
Cabot, Samuel, 24 W. Kinzie St. 678
Wood Conversion Co., 310 S. Michigan 36

PARTITION TILE.

(See Hollow Tile)

PARTITIONS—TOILET

Alberene Stone Co., 1700 Elston Av. 579
Peerling Marble Co., 2891 Hillock Av. Inside Back Cover

PIANOS.

Lyon & Healy, Inc., Jackson Blvd. & Wabash Ave. 20

PILING—WOOD.

Lake Superior Piling Co., 961 W. 22nd 344

PIPE ORGANS.

Lyon & Healy, Inc., Jackson Blvd. & Wabash Ave. 20

PIPE AND BOILER COVERING.

Cent. Asbestos & Mag. Co., 214 W. Grand 518
Johns-Manville, Inc., 18th & Michigan 8
Krez, Paul J. Co., 444 N. La Salle St. 516
Luse-Stevenson Co., 307 N. Michigan 54
Standard Asbestos Mfg. Co., 816 W. Lake 520

PLASTER.

U. S. Gypsum Co., 205 W. Monroe St. 40

PLASTER BASE.

Simplex Steel Prod. Co., 1146 Roscoe St. 664

PLASTER BOARD.

Bird & Son, 1472 W. 76th St. 22
U. S. Gypsum Co., 205 W. Monroe St. 40

PLASTERING CONTRACTORS.

Balhatchet, Wm. Co., 58 W. Washington 674
Brown, James J., Plastering Co., 53 W. Jackson Blvd. 672
Cousins, H. A. Inc., Straus Bldg. 670
Goss & Guise, 189 W. Madison St. 676
Kalteux & Brown Co., 25 N. Dearborn 676
Lennox-Haldeman Co., 208 S. La Salle 675
Middleton, Edward Co., 133 W. Wash. 677
McNulty Bros. Co., 1028 W. Van Buren 668
Parent, N. J. Co., 5 S. Wabash Av. 675
Sutton Plastering Co., 25 E. Jackson Bl. 674
Zander-Reum Co., 7 S. Dearborn St. 666

PLASTERING MATERIAL.

Consumers Co., 111 W. Washington Bl. 116
U. S. Gypsum Co., 205 W. Monroe St. 40

PLATE GLASS SETTING

Brasco Mfg. Co., 5035 S. Wabash Av. 658
Kawneer Co., 111 W. Washington Blvd. 32
Zouri Drawn Metals Co., Chicago Heights, Ill. 652

PLUMBING SUPPLIES.

Clow, Jas. B. & Sons, Lake, Talman & Fulton 594
Crane Co., 836 S. Michigan Av. 534 & 600
Hoffman & Billings Mfg. Co., Milwaukee, Wis. 608
Imperial Brass Mfg. Co., 1232 W. Har. 602
Kellogg, Mackay Co., 419 W. 18th St. 522
Kohler Co., 431 N. Michigan Av. 598
Standard Sanitary Mfg. Co., 3700 Iron 596
Weil-McLain Co., 641 W. Lake St. 528
Wolff Mfg. Co., 225 N. Hoyne Av. 592

PLUMBING, GASFITTING AND SEWERAGE.

Am. Heat. & Plumb. Corp., 189 N. Clark 568
Baggot, E. Co., 55 E. Lake St. 620
Corboy, M. J. Co., 178 W. Randolph St. 616
Griffith, Wm. H., 3656 Broadway 624
Hanley & Co., 6 N. Clark St. 622
Howlett Bros., 20 W. Jackson Blvd. 618
Kohlbry-Howlett Co., 63 W. Ontario St. 576
Murphy Plumbing Co., 1720 S. Michigan 625
Nilson Bros., 3222 N. Halsted St. 572
Noble & Thumm, 1065 Addison St. 624
Watson, W. W., 708 Carpenter St. 625

POST CAPS.

Castle, A. M. & Co., 1300 N. Branch 472

POWER EQUIPMENT.

Stannard Power Equipment Co., 53 W. Jackson Blvd. 540

PUMPS—AUTOMATIC AND HYDRAULIC.

Am. Steam Pump Co., 53 W. Jackson Bl. 540
Chicago Pump Co., 2336 Wolfram St. 577
Fairbanks-Morse & Co., 900 S. Wabash 120
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

PUMPS—ELECTRIC.

Chicago Pump Co., 2336 Wolfram St. 577
Fairbanks-Morse & Co., 900 S. Wabash 120
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

PUMPS—STEAM.

Am. Steam Pump Co., 53 W. Jackson Bl. 540
Chicago Pump Co., 2336 Wolfram St. 577
Fairbanks-Morse & Co., 900 S. Wabash 120

RADIATORS.

Am. Radiator Co., 820 S. Michigan Av. 538
Kewanee Boiler Co., 820 W. Washington 524

RADIATORS—GAS.

Clow, Jas. B. & Sons, Lake, Talman & Fulton 594
Peoples Gas Light & Coke Co., 122 S. Michigan Ave. 400-402

RADIATOR COVERS.

Art Metal Radiator Cover Co., 1730 N. Kolmar Av. 552
Hayward, R. B. Co., 1714 Sheffield Av. 573

RADIATOR VALVES—PACKLESS.

Crane Co., 836 S. Michigan Av. 534 & 600
Dunham, C. A. Co., 230 E. Ohio St. 536

REFLECTORS—DIRECT & INDIRECT.

Beardslee Chandelier Mfg. Co., 216 S. Jefferson Av. 372
Central Electric Co., 320 S. Wells St. 358
Everson, C. G. & Co., 70 W. Lake St. 364
Frink, I. P. Inc., 53 W. Jackson Blvd. 362
Harter Mfg. Co., 1850 Fulton St. 370
Herwig Co., 1753 Sedgwick St. 366
Overbagh & Ayres Mfg. Co., 411 S. Clinton St. 368
Pearlman, Victor S. & Co., 533 S. Wabash 352

REFRIGERATION—ELECTRIC.

Commonwealth Edison Co., 72 W. Adams 378
Kelvinator-Chicago, Inc., 14 E. Jackson 590
Servel Electric Refrigeration, 72 W. Adams St. 588

REFRIGERATORS.

Brunswick-Balke-Collender Co., 623 S. Wabash Av. 12 & 606
Commonwealth Edison Co., 72 W. Adams 378
Janows & Kramer Co., 1637 Carroll Av. 350
Kelvinator-Chicago, Inc., 14 E. Jackson 590
Matot, D. A., 1538 Montana St. 82-349
McCray Refrigerator Corp., 360 N. Mich. Av. and Kendallville, Ind. 2
Pick, Albert & Co., 212 W. Randolph 66
Servel Electric Refrigeration, 72 W. Adams St. 588
Wasmuth Endicott Co., Anderson, Ind., & Furniture Mart, Chicago 406

REFRIGERATED ROOMS INSULATION.

United Cork Companies, 1151 Eddy St. 92

REGULATORS—DAMPER.

Davis, G. M. Reg. Co., 422 Milwaukee 577
Dunham, C. A. Co., 230 E. Ohio St. 536

REGULATORS—HEAT—STEAM—AIR—WATER.

Davis, G. M. Reg. Co., 422 Milwaukee 577
Dunham, C. A. Co., 230 E. Ohio St. 536
Hoffman & Billings Mfg. Co., Milwaukee, Wis. 608
Johnson Service Co., 1355 Washington 578

REINFORCING BARS.

Calumet Steel Co., 208 S. La Salle St. 450
Castle, A. M. & Co., 1300 N. Branch 472
Concr. Engineering Co., 1926 S. 52nd Av. 448
Scully Steel & Iron Co., 2364 S. Oakley 470

REINFORCING STEEL FABRIC.

(See Steel Fabric for Reinforcing Concrete)

ROLLING PARTITIONS—WOOD AND STEEL.

Dodge, H. B. & Co., 332 S. Michigan Av. 351

ROOF DRAINS.

Wade Iron Sanitary Mfg. Co., 551 Fulton 614

ROOF TRUSSES.

Husak & Root, 833 N. California Av. 296
McKeown Bros. Co., 112 W. Adams 152

ROOFING CONTRACTORS.

Moore, Edw., Rfg. Co., 2729 W. Madison 70

ROOFING—MATERIALS.

Amalgamated Rfg. Co., 431 S. Dearborn 349
Am. Tar Products Co., 208 S. La Salle St. 347
Beckman-Dawson Rfg. Co., 111 W. Jack. 678
Bird & Son, 1472 W. 76th St. 22
Johns-Manville, Inc., 18th & Michigan 8
Luse-Stevenson Co., 307 N. Michigan 54
Moore, Edw., Rfg. Co., 2729 W. Madison 70
Wood Conversion Co., 208 S. La Salle St. 36

ROOFING TILE.

Federal Cement Tile Co., 608 S. Dearborn 16
Hawthorne Roofing Tile Co., 2136 S. 48th Av., Cicero, Ill. 26
Ludowici-Celadon Co., 104 S. Michigan 84

RUBBER TILE.

Salisbury, W. H., & Co., Inc., 308 W. Mad. 80
Wright Rubber Products Co., Racine, Wis. 78

RUGS AND CARPETS—ORIENTAL AND DOMESTIC.

Hardwick & McGee Co., 29 E. Madison Inside Front Cover
Pick, Albert & Co., 212 W. Randolph 66

SAND BLASTING.

Paschen, Chr., 133 W. Washington Blvd. 334

SAND AND GRAVEL.

Consumers Co., 111 W. Washington Blvd. 116
Dee, Wm. E. Co., 30 N. La Salle St. 488

SASH, DOORS AND BLINDS.

(See Millwork)

SASH OPERATORS.

Cobb, Whyte & Laemmer Co., 309 W. Madison St. 346
Detroit Steel Prod. Co., 111 W. Wash. 410
Lupton, David Sons Co., 28 E. Jackson 408
Midwest Hardware Co., 56 W. Randolph 58

SASH—STEEL.

Detroit Steel Prod. Co., 111 W. Wash. 410
Lupton, David Sons Co., 28 E. Jackson 408

SCAGLIOLA.

Cousins, H. A., Inc., Straus Bldg. 670
Kalteux, Nic., 220 S. State St. 434

SCALES.

Fairbanks-Morse & Co., 900 S. Wabash 120

SCHOOL EQUIPMENT.

Rowles, E. W. A. Co., 2345 S. La Salle St. 122

SCREENS—WINDOW AND DOOR.

Burrowes Weather Strip Co., 2163 N. California Av. 76
Chamberlin Metal Weather Strip Co., 704 S. Dearborn St. 347

SCUPPERS & FLOOR DRAINS.

Dickinson, Aoelus Co., 3338 S. Artesian 532
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

SECURITY BONDS FOR CONTRACTORS.

Builders & Mfgrs. Mutual Casualty Co., 133 W. Washington St. 24

SEATS—CLOSET.

Brunswick-Balke-Collender Co., 623 S. Wabash Av. 12 & 606
Built Well Mfg. Co., 1458 W. Kinzie St. 612

SEWER PIPE.

Dee, Wm. E. Co., 30 N. La Salle St. 488

SEWAGE EJECTORS AND BILGE PUMPS.

Chicago Pump Co., 2336 Wolfram St. 577
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

SHADES FOR INDUSTRIAL BUILDINGS.

Maxwell, S. A. & Co., Inc., 3636 Iron St. 90

SHEATHING MATERIALS.

Bird & Son, 1472 W. 76th St. 22
Johns-Manville, Inc., 18th & Michigan 8

SHEET METAL WORKS.

Biegler, Louis Co., 165 N. Curtis St. 587
Haines Co., 1929 W. Lake St. 587
Hayward, R. B. Co., 1714 Sheffield Av. 573
Monarch Vent. Co., 1338 Sedgwick St. 586
Narowetz Heat. & Vent. Co., 1711 Park 580

SHELVES—STEEL FOR FACTORIES.

Durand Steel Locker Co., 76 W. Monroe St. 18
Federal Steel Fixture Co., 4545 Homer 56

SHINGLES.

(See Lumber)

SHINGLES—FIREPROOF.

Amalgamated Rfg. Co., 431 S. Dearborn 349
Beckman Dawson Rfg. Co., 111 W. Jack. 678
Bird & Son, 1472 W. 76th St. 22
Cabot, Samuel, Inc., 5000 Bloomingdale 678
Johns-Manville, Inc., 18th & Michigan 8

SHINGLE STAINS.

Am. Tar Products Co., 208 S. La Salle St. 347
Cabot, Samuel, Inc., 5000 Bloomingdale 678
Detroit Graphite Co., 208 S. La Salle St. 636
Lucas, John & Co., 1362 W. 37th St. 634
Moore, Benj. & Co., 415 N. Green St. 638
Ohmlac Paint & Refining Co., 140 S. Dear. 346

SHORING CONTRACTORS.

Friestedt, L. P. Co., 7 S. Dearborn St. 330

SHOWER MIXERS.

Hoffman & Billings Mfg. Co., Milwaukee, Wis. 608

SHOWER RECEPTORS.

Chicago Art Marble Co., 2883 Hillock St. 424

SHOWERS.

Hoffman & Billings Mfg. Co., Milwaukee, Wis. 608

SIDEWALK DOORS.

Am. 3 Way-Luxfer Prism Co., Cicero, Ill. 38 & 654
Hill, O. H. Co., 2253 St. Paul Av. 444
Simpson-Frisch Co., 1401 Wabansia Av. 483
Western Iron Constr. Co., 4906 N. Clark 482

SIDEWALK AND VAULT LIGHTS.

Am. 3 Way-Luxfer Prism Co., Cicero, Ill. 38 & 654

SIGNS—CHANGEABLE.

Tablèt & Ticket Co., 1015 W. Adams St. 68

SKYLIGHTS.

Am. 3 Way-Luxfer Prism Co., Cicero, Ill. 38 & 654
Biegler, Louis Co., 165 N. Curtis St. 587
Detroit Steel Prod. Co., 111 W. Wash. 410
Federal Cement Tile Co., 608 S. Dearborn 16
Lupton, David Sons Co., 28 E. Jackson 408

SLUICE GATES.

Crane Co., 836 S. Michigan Av. 534 & 600
Imperial Brass Mfg. Co., 1232 W. Harrison St. 602
Wade Iron Sanitary Mfg. Co., 551 Fulton 614

SMOKE STACK LININGS.

Cent. Asbestos & Mag. Co., 214 W. Grand 518
Krez, Paul J. Co., 444 N. La Salle St. 516
Standard Asbestos Mfg. Co., 816 W. Lake 520

SOUND PROOFING.

Hylonite Products Co., 1107 Addison St. 74
Johns-Manville, Inc., 18th & Michigan 8
Wood Conversion Co., 310 S. Michigan 36

SPIRAL CHUTES.

Olson, Samuel & Co., 2418 Bloomingdale 14
Link-Belt Co., 300 W. Pershing Road 114
Weller Mfg. Co., 1820 N. Kostner Av. 108

SPRINKLER SYSTEMS.

Ill. Malleable Iron Co., 1801 Diversey 578

STAINS.

Berry Bros., Inc., 119 W. Grand Av. 662
Devoe & Raynolds Co., 14 W. Lake St. 628
Du Pont, E. I. de Nemours & Co., 2100 Elston Av. 632
Pratt & Lambert, Inc., 320 W. 26th St. 626

STAIR TREADS.

Castle, A. M., & Co., 1300 N. Branch 472
Hylonite Products Co., 1107 Addison St. 74
Scully Steel & Iron Co., 2364 S. Ashland Ave. 470

STAIRS AND RAILINGS—WOOD.

Anderson & Lind Mfg. Co., 2127 Iowa St. 48
Baumann, Poe Mfg. Co., 1501 Smith 44
Chicago Sash Door & Blind Mfg. Co., 1249 W. North Ave. 50
Edmunds Mfg. Co., 2016 Washburne Av. 46
Johnson-Schweizer Co., 1249 W. North 50
Matthews Bros. Mfg. Co., Milwaukee, Wis. 752
West Woodworking Co., 310 N. Ada St. 42

STAIRS—IRON AND BRONZE.

(See Architectural Iron and Bronze)

STAIRS—STEEL.

Guarsteel Safety Stair Co., 3847 W. Lake 468
Woodbridge Ornamental Iron Co., 1519 Altgeld St. 446-447

STEAM HEATING.

(See Heating—Hot Water and Steam)

STEAM GENERATORS.

Am. Radiator Co., 820 S. Michigan Av. 538
Johnson Service Co., 1355 Washington Bl. 578
Kewanee Boiler Co., 320 W. Washington 524

STEEL BARS FOR REINFORCING CONCRETE.

(See Reinforcing Bars)

STEEL CABINETS.

Majestic Steel Cabinet Co., 4229 Belle Plaine Av. 4
Morton Mfg. Co., 5133 W. Lake St. 124

STEEL FABRIC FOR REINFORCING CONCRETE.

Consol. Exp. Metal Co., 1231 W. Wash. 34

STEEL JOISTS.

Massillon Steel Joist Co., 208 S. La Salle 452

STONE COATING.

Ohmlac Paint & Refining Co., 140 S. Dear. 346

STONE—ARTIFICIAL.

Benedict Stone Co., 208 S. La Salle St. 498

STONE-CUT BUILDING.

Cent. Oolitic Stone Co., 2126 S. Kedzie 494
Hoadley, J. & Sons Co., Bloomington, Ill. 496
Indiana Quarries Co., 112 W. Adams St. 490
McMillan, Wm. & Son, 10 S. La Salle St. 492

STORE FRONTS—METAL CONSTRUCTION.

Brasco Mfg. Co., 5035 S. Wabash Av. 638
Hamilton Glass Co., 415 N. Elizabeth St. 660
Hooker, H. M. Glass & Paint Co., 651 W. Washington Blvd. 662
Kawneer Co., 111 W. Washington Blvd. 32
Sharp, Partridge & Co., 2263 Lumber St. 656
Zouri Drawn Metals Co., Chicago Heights, Ill. 652

STORE AND OFFICE FIXTURES.

Anderson & Lind Mfg. Co., 2127 Iowa St. 48
Baumann, Poe Mfg. Co., 1501 Smith 44
Brunswick-Balke-Collender Co., 623 S. Wabash Av. 12 & 606
Edmunds Mfg. Co., 2016 Washburne Av. 46
Johnson-Schweizer Co., 1249 W. North 50
Matthews Bros. Mfg. Co., Milwaukee, Wis. 752
Pick, Albert & Co., 212 W. Randolph 66
West Woodworking Co., 310 N. Ada St. 42

STOVES—GAS.

Cribben & Sexton Co., 600 N. Sacramento 404
Peoples Gas Light & Coke Co., 122 S. Michigan Blvd. 400-402
Pick, Albert & Co., 212 W. Randolph 66

STRAINERS—SUCTION.

Dunham, C. A., Co., 230 E. Ohio St. 536

STREET LIGHT POSTS—CONCRETE.

Am. Concrete Prod. Co., 30 N. La Salle St. 398

STRUCTURAL IRON AND STEEL.

American Bridge Co., 208 S. La Salle St. 436
Bolter's, A. Sons, 2301 Ward St. 480
Duffin Iron Co., 4837 S. Kedzie Ave. 442
Federal Iron Wks., 30 N. La Salle St. 480
Halsted, Joseph Co., 31st & Spaulding 478
McClintic Marshall Co., 38 S. Dearborn 440
Scully Steel & Iron Co., 2364 S. Ashland 470
Simpson-Frisch Co., 1401 Wabansia Av. 483
Strobel Steel Constr. Co., 53 W. Jackson 438
Union Fdry. Wks., 38 S. Dearborn St. 472
Western Iron Constr. Co., 4906 N. Clark 482

STUCCO.

Muller, Franklin R., Inc., Waukegan, Ill. 1

SURETY BONDS.

Builders & Mfrs. Mutual Casualty Co., 133 W. Washington St. 24

SURVEYORS—CITY AND COUNTY.

Greeley-Howard-Norlin Co., 127 N. Dear. 342
Jones, W. D., 8 S. Dearborn St. 342
Kramer, Wm., 8 S. Dearborn St. 342
Silander, A. I., 30 N. La Salle St. 343

SWITCHBOARDS.

Berthold, Gus., Electr. Co., 555 W. Monroe 380
Electric Apparatus Co., 702 N. Halsted 376
Newgard, Henry & Co., 4603 Fullerton Av. 382

TANKS—IRON AND STEEL.

Freeman Mfg. Co., 53 W. Jackson Blvd. 546
Kewanee Boiler Co., 820 W. Washington 524

TEMPERATURE REGULATORS.

Johnson Service Co., 1355 Washington 578

TERRA COTTA.

Am. Terra Cotta & Ceramic Co., 1701 Prairie Ave. 60
Midland Terra Cotta Co., 105 W. Monroe 30
Northwestern Terra Cotta Co., 2525 Clybourn Av. 10

TERRAZZO WORK.

Chicago Art Marble Co., 2883 Hillock 424
National Mosaic Tile Co., 2901 S. Cicero 426
Novak Mosaic Co., 2019 Walnut 434

THERMOSTATS.

Dunham, C. A. Co., 230 E. Ohio St. 536
Johnson Service Co., 1355 Washington 578

TILE—CERAMIC, ETC.

Am. Encaustic Tiling Co., 332 S. Mich. 412
Hawes & Dodd, 59 E. Adams St. 428
Hawkinson, John S. Co., 80 E. Jackson 428
Interior Tiling Co., 21 E. Van Buren 430
Jackson, Wm. H. Co., 318 N. Michigan 432
Lorenzen, Chas. F. & Co., 521 W. Monroe 422
McWayne Co., 639 N. Wells St. 430
Mosaic Tile Co., Kimball Bldg. 414
Nat. Tile Co., 59 E. Adams 432
Rees Tile Co., 4406 N. Clark St. 420
Updike & Co., 230 E. Ohio St. 418

TILE—CORK.

United Cork Companies, 1151 Eddy St. 92

TILE—FLOORS.

Am. Encaustic Tiling Co., 332 S. Mich. 412
Chicago Art Marble Co., 2883 Hillock 424
Hawes & Dodd, 59 E. Adams St. 428
Hawkinson, John S. Co., 80 E. Jackson 428
Interior Tiling Co., 21 E. Van Buren 430
Jackson, Wm. H. Co., 318 N. Michigan 432
Lorenzen, Chas. F. & Co., 521 W. Monroe 422
McWayne Co., 639 N. Wells St. 430
Mosaic Tile Co., Kimball Bldg. 414
National Mosaic Tile Co., 2901 S. Cicero 426
Nat. Tile Co., 59 E. Adams 432
Rees Tile Co., 4406 N. Clark St. 420
Updike & Co., 230 E. Ohio St. 418

TILE—GYPSUM.

U. S. Gypsum Co., 205 W. Monroe St. 40

TILE—HOLLOW.

Continental Fireproofing Co., 220 S. State 486
Dee, Wm. E. Co., 30 N. La Salle St. 488
Ill. Fire-proof Constr. Co., 209 S. La Salle St. 484
Nat. Fire Proofing Co., 2610 Shields Av. 486

TILE—ROOF.

Federal Cement Tile Co., 608 S. Dearborn 16
Hawthorne Roofing Tile Co., 2136 S. 48th Ave., Cicero, Ill. 26
Ludowici-Celadon Co., 104 S. Michigan 84

TILE RUBBER.

Salisbury, W. H. & Co., 308 W. Madison 80
Wright Rubber Products Co., Racine Wis. 78

TILE WAINSCOTING.

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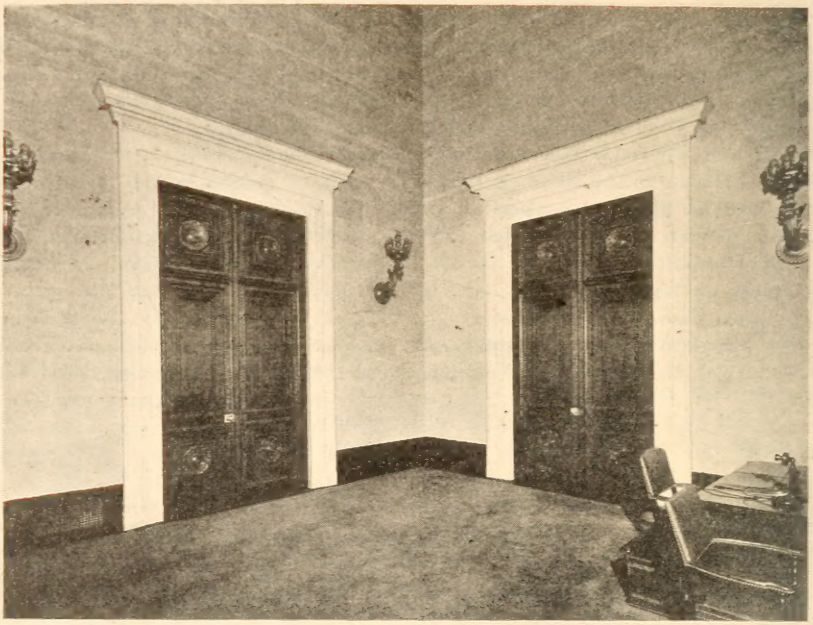

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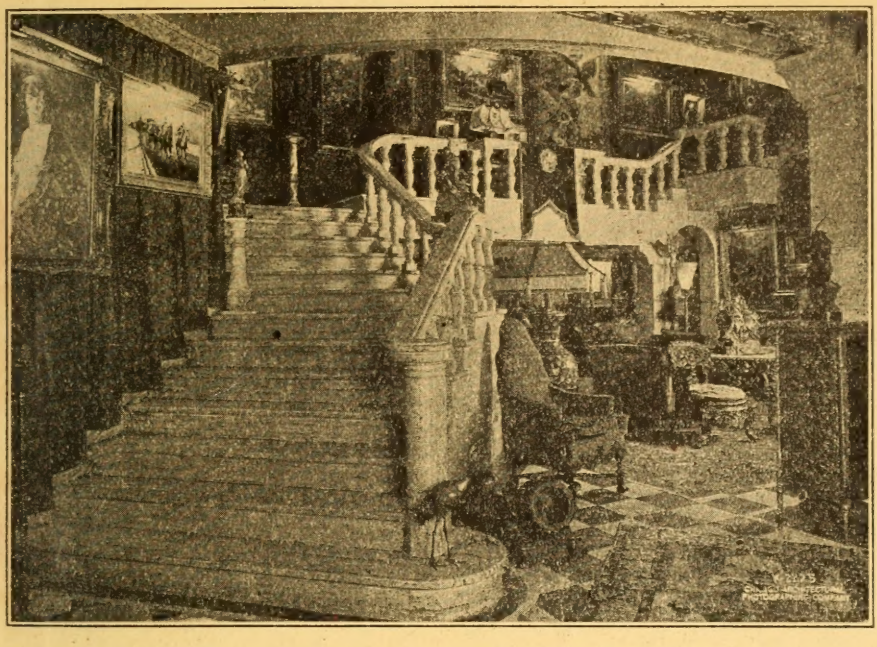

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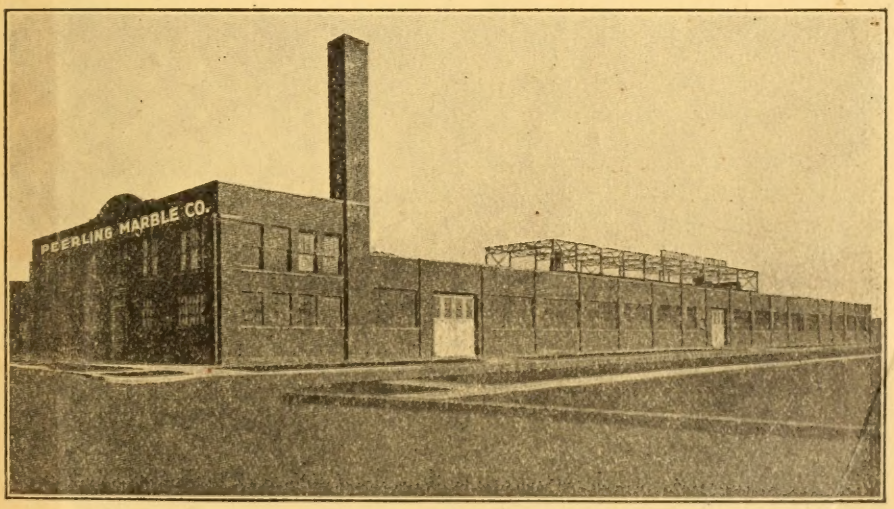

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